MAY

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

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Bleeding from Oral Tissues—*Birch*
Accidents to Teeth of Young—*McBride*
Precolumbian Indian Skulls—*Sedwick*
Azochloramid—*Grossman*
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A Most Satisfactory Dental Law

COUNCIL ON DENTAL THERAPEUTICS
Accepted Dental Remedies

BUREAU OF PUBLIC RELATIONS
Survey of Children's Dentistry

DENTAL ECONOMICS
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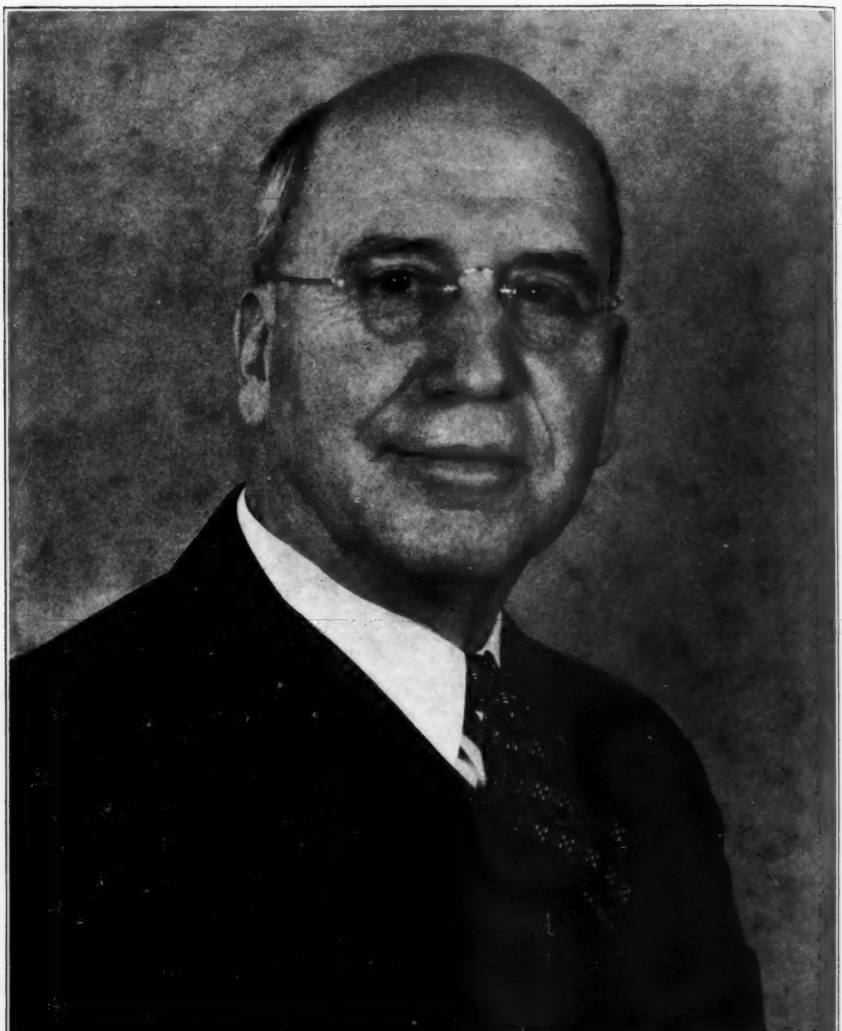
The Journal of the American Dental Association. Vol. XXIII, No. 5. Published by the American Dental Association, 212 East Superior Street, Chicago, Ill. Yearly subscription $5.00. Entered as second-class matter, May 1, 1928, at the postoffice at Chicago, Ill., under the act of Aug. 24, 1912. Published monthly.
Copyright, 1936, by the American Dental Association.



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President of the American College of Dentists

THE JOURNAL
of the AMERICAN DENTAL ASSOCIATION

Vol. 23 MAY, 1936 No. 5

Original Communications

INTERRELATIONSHIP OF DENTAL PRACTICE AND GENERAL MEDICINE*

By JOHN BELL WILLIAMS, Ph.G., D.D.S., Richmond, Va.

THOSE of us who feel that a medical degree is unnecessary for dentists will admit that a lack of bedside training has ever been a millstone around our necks, particularly since the discovery of the close relationship between oral sepsis and many systemic diseases. Similarly, no one can now deny that a working understanding of the oral findings in general disease and the general symptoms occasioned by oral disease would erect a milestone in the path of both medical and dental progress.

These ideas arising from my hospital and teaching experience have led me to assemble this paper. An attempt will be made to lift the veil surrounding a few medicodental problems and, by selecting a sign or symptom here and a case report there, to draw verbal sketches that will emphasize the value of general medicine to dental practice.

*From the McGuire Clinic, St. Luke's Hospital.

FOCAL INFECTION

Throughout medical history, an occasional reference is made to the relationship between oral sepsis and systemic disease, although these references received little attention until twenty years ago. Since then, the news has traveled fast, lifting dentistry into increased prominence with promises hard to fulfil.

Ten years ago, of 150 consecutive patients who entered St. Luke's Hospital, Richmond, Va., for purely surgical conditions, ranging from brain tumors to enlarged prostate glands, 40 per cent had recently had one or more teeth extracted in the hope that a major operation would thus be avoided. The sweeping removal of teeth had its day, until finally condemnation of "teeth and tonsils" became the commonplace. History proves that honest men who propose radical changes become conservative in proportion to their ability to comprehend and apply the detailed knowledge of the facts involved.

The development of the theory of focal infection has followed this general rule. Equilibrium is becoming established through experience. As we observe, compare, reflect and record, we become more rational.

Because of a lack of familiarity each with the other's reasoning, controversies still develop between physicians and dentists. At St. Luke's Hospital, we seem to have evolved unconsciously a plan that avoids friction. Teeth that are definitely diseased are removed. Teeth that are questionable are reported in detail. Their retention or removal is so often dependent on other findings that the final decision is left to the man responsible for the patient's welfare as a whole, or to a consultation. If a patient has doubtful teeth and a systemic disease not associated with focal infection, our advice is conservative; but if the patient is suffering from a general condition believed to be associated with focal infection, our advice might be called rationally radical. This view makes the term "systemic disease" too general for daily use.

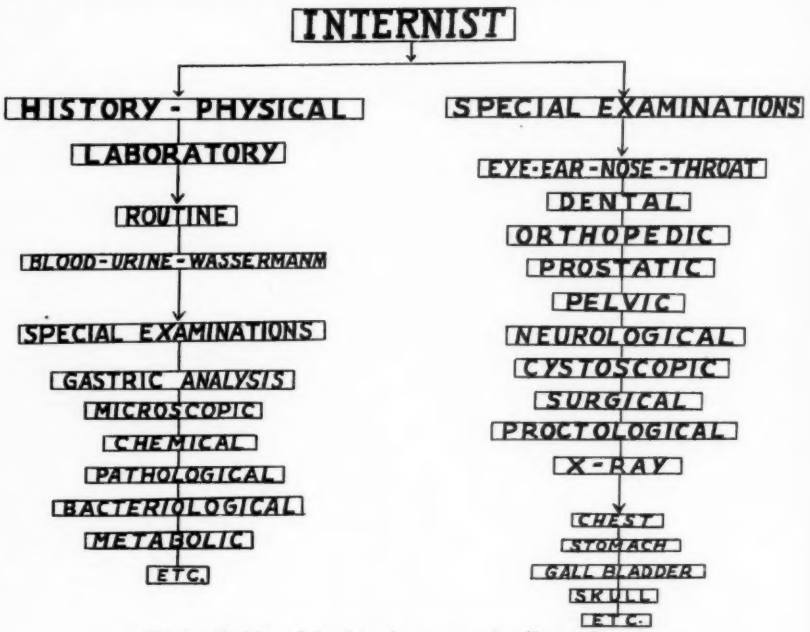

Fig. 1.—Position of dentistry in average size diagnostic group.

CHRONIC NEPHRITIS

To give a practical illustration, let us assume that a patient with disease of the "urinary system" is found to have suspicious looking pulpless teeth. In determining what procedure to follow, the logical thing is to ascertain from the attending physician the nature of the urinary trouble. Is it in the kidneys, the ureters, the bladder or the urethra? Is it complicated with disease in other organs or systems? The answers to these and

other questions may be the determining factors in our conclusion. Let us again presume that the kidney is the seat of the trouble. Before deciding what to do about the teeth, we must know more of the kidney disease. If it is a kidney stone, extracting the teeth certainly will not remove the stone. Again, if one kidney contains a cyst, the surgical removal of that kidney may be desirable regardless of the condition of the teeth. If both kidneys have developed numerous cysts throughout, death is sure to follow, and the extraction of teeth would only subject the patient to an unnecessary physical ordeal and financial strain. Proceeding further, let us say that this patient has chronic nephritis. This disease is usually classified by medical writers in three large groups, as (1) chronic interstitial nephritis, (2) nephrosis and (3) chronic parenchymatous nephritis. In the first two types, oral sepsis plays no direct part, but, in chronic parenchymatous nephritis, it is considered of prime importance to remove all foci of infection because from these foci an acute flareup of an existing chronic kidney condition may arise at any time. With this information at hand, the fate of doubtful teeth in chronic parenchymatous nephritis no longer remains unsettled. The removal of every tooth that might act as a focus is justified.

Fig. 2.—Scar on face from oral ulcer in diabetes following extraction of mandibular molar.

Just as the dentist has studied the patient's system of mastication, so must the physician examine other systems. The order of carrying out treatment is best suggested by the one man who has studied all of the specialists' reports, for he alone knows all the facts.

ARTERIOSCLEROSIS

Let us next consider a disease of the arteries. When it was found that very small doses of drugs would cure certain diseases, a few faddists jumped to the conclusion that all drugs should be given in minute doses. Thus, homeopathy! When it was found that some people were benefited by massage, this form of secondhand exercise was installed as a cureall under the name osteopathy. Regular physicians of long ago stumbled on the fact that bloodletting was beneficial to certain sick people. Thus, many patients were bled regardless of the nature

Fig. 3.—Pyorrhea in diabetes.

of their disease. Those who were benefited were no doubt suffering from high blood pressure, which is a symptom of several diseases, including arteriosclerosis.

This disease is of more than passing interest to the dentist. Reduced to plain terms, it is a chronic disease of the arteries characterized by the infiltration of fibrous tissue and lime salts into the walls of the vessels, causing them to become hardened, with a narrowing of the lumen. In this state, the circulatory system may be compared to a water system in which soft elastic hose is replaced with hard unyielding metal pipe. If the pressure exerted within the system remains the same after the pipes are changed from soft rubber to iron, naturally the pressure in the end pipes, or arteries, will rise. In handling steam, a safety valve is used to let off pressure. Bloodletting acts as such a measure for man.

Arteriosclerosis, a physiologic process in old age, is brought about pathologically in earlier years by syphilis, alcoholism, worry, stress, overwork, intestinal toxemia and focal infection. Its changes involve the heart, which has had a heavy load added to its daily routine, the kidneys, which often develop nephritis, and the brain, patients talking of dizziness, headache, tightness around the head, and numbness in the arms and legs. It is often complicated by a stroke of apoplexy and sometimes by gangrene of a toe or foot.

Conceding that there may be doubt as to what part oral sepsis plays in this disease, it is believed that the elimination of all foci of infection gives the patient a better chance to handle the arteriosclerotic condition; hence, in the medical treatment of these patients, usually all questionable teeth should be extracted.

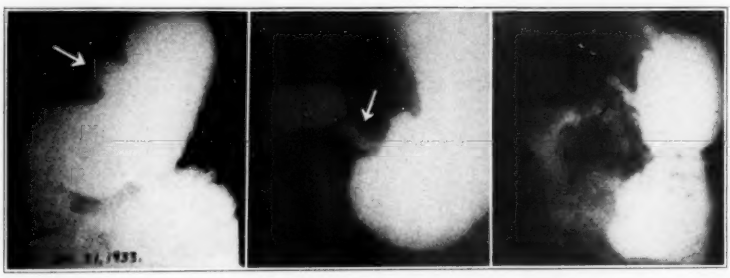

Fig. 4.—Appearance of: Left, ulcer of stomach. Center, syphilitic area in stomach. Right, cancer of stomach.

DIABETES

Of equal interest is the disease known as diabetes. The chief characteristic of this condition is a disordered carbohydrate metabolism in which sugar is no longer properly stored in the liver and muscles as glycogen, but circulates in abnormal quantities in the blood and finds its way through the kidneys into the urine. It is attended by dry skin, excessive thirst, frequent urination, marked emaciation and loss of strength. The disease is, to a certain extent, hereditary, as it tends to occur in certain families. It is apparently more frequent in the Jews than in other races, and it is much more surely fatal in children than in adults. Extreme cases terminate either

in gangrene of the extremities or in total failure of the body chemistry, with the fatal though merciful intervention of coma.

The importance of eliminating focal infection from diabetic patients is agreed on by both the medical and the dental profession, while some enthusiasts go so far as to claim that as the oral infection subsides, sugar is correspondingly reduced.

Another important consideration in such cases is the choice of time for oper-

RED BLOOD CORPUSCLES: 1,500,000 Per Cu. m. m.
(Normal 4,500,000—5,000,000)

MICROCYTES	✓
MEGALOCYTES	✓
POIKILOCYTES	✓
POLYCHROMATOPHILIA	✓
GRANULAR DEGENERATION	✓
NORMOBLASTS, Per 100 Leucocytes	few
INTERMEDIATE, Per 100 Leucocytes	few
MEGALOBLASTS, Per 100 Leucocytes	numerous
HAEMOGLOBIN (Normal 80-90%)	35%
COLOR INDEX	1.1
MALARIAL PARASITES	0
PLATES	diminished

LEUCOCYTES: 4000 Per Cu. m. m.
(Normal 5,000—10,000)

POLYNUCLEAR NEUTROPHILES (Normal 66-75 per cent.)	55 per cent.
LYMPHOCYTES (Normal 22-25 per cent.)	35 per cent.

Fig. 5.—Typical report of blood examination in pernicious anemia.

ative procedure. Some observers feel that unless the urine is free from sugar, and the blood sugar is within normal limits, wounds in the diabetic may fail to heal. The use of insulin and the regulation of the diet by a physician make it possible for these patients to have the benefit of surgical procedures (including dental, of course), at any time they may be needed.

The fact that practically all these patients have pyorrhea leads us to further interest in this disease. Certain medical writers remind us that the presence of glucose in the blood stream lowers resistance and it makes an excellent culture medium. The biochemists feel that the absorption of bone seen in pyorrhea may be due to the continual acidosis from which these patients suffer. Certain it is that their tissues have a poor "come back." The number of pyorrhea patients who have diabetes is small, but the number of diabetic patients who have pyorrhea is large. They cannot be satisfactorily treated by either physician or dentist working alone.

"STOMACH TROUBLE"

" . . . good digestion wait on appetite and health on both" describes an ideal condition. The American people are unhappily the frequent victims of dyspepsia. Out of every ten people who complain of indigestion, not more than one actually has organic disease of the stomach. The stomach has aptly been likened to a fire bell, because it gives the alarm for a disturbance located elsewhere. If the stomach alone were treated every time it sounded an alarm, many a diagnosis would have to be regarded faulty.

Indigestion may have a number of causes ranging from an infection of the gallbladder, appendicitis and constipation to eye strain and worry. This does not mean that the stomach is immune to disease. In fact, it is subject to many disorders. The most important are acute gastritis, chronic gastritis, ulcer and cancer.

Years ago, dentists treated and filled teeth to improve mastication and thus prevent or cure ulcers of the stomach. Their sons now extract the same teeth for the same purpose. The sons act on the "newer knowledge" that focal infection, particularly the type associated with pulpless teeth, is a possible cause of these ulcers. Those who advance this theory have not explained why peptic ulcers oc-

cur more often in men than in women, frequently give their symptoms in the spring or early summer, are very common in some localities and occur often among certain workers.

Stuart McGuire has stated that the majority of successful dentists over 50 years of age are the victims of dyspepsia, and he attributes this fact to the nerve strain and confinement of their work. These factors are being rapidly removed by the use of anesthesia and indulgence in golf.

A discussion of dentistry and digestion cannot close without reference to the thousands of toothless people who have good digestion and live to a ripe old age.

PREGNANCY

The barber-dentist-surgeon of long ago contented himself with the relief of pain by the extraction of teeth. Later on, the tradesman-dentist prided himself on perfecting a mechanical machine for mastication. Today, the professional dentist is not content solely with the comfort and health of his individual patient, but he must consider in addition the growth and development of the teeth of generations yet unborn.

Fig. 6.—*A*, stone in gallbladder, which will not produce jaundice. *B*, stone in hepatic duct, which will produce jaundice. *C*, stone in cystic duct, which will not produce jaundice. *D*, stone in common duct, which will produce jaundice. *E*, stone at ampulla of Vater, which will produce jaundice and disturb pancreatic function. *F*, stone in duodenum, causing no symptoms.

The theory that the food of an expectant mother should have special attention is not new. That the amount of food necessary to nourish two people is greater than that required by one seems common sense, though some dentists believe that regardless of the food she eats a woman with good teeth who becomes pregnant will become a mother with good teeth. Any dissent from this opinion they class in the category with maternal impressions. Others equally sincere believe without question the folkloristic adage "for every child a tooth."

So much has been written recently on diet and dentistry that one hesitates to summarize the findings. Miller's theory that tooth decay results from the breaking down of carbohydrates into acids is familiar to us all. Black recognized periods of susceptibility and immunity to dental decay. The day will doubtless come when we will hear more about the influence of heredity on tooth formation. Certain it is that if we paid as much attention to breeding people as we do to breeding hogs and cattle, there would be more thoroughbreds.

Modern investigators substantiate the observations of Miller and Black, but add thereto the belief that immunity to decay depends on the formation of teeth free from imperfections of calcification. The development of sound tooth structure, they say, is due to the metabolism of calcium and phosphorus, in the presence of vitamins, by some unknown activity of the parathyroid glands.

From these theories, we as clinical practitioners can only instruct the pregnant patient in mouth hygiene; eliminate infections; replace lost tooth structure, and, unless there is medical contraindication, advise a balanced diet.

In carrying out operative treatment, there is a serious complication in many parts of the country, because there are many lay people who believe that it is dangerous for a woman to have dental treatment during pregnancy. If miscarriages could be produced by dental operations, there might possibly be need for concern on the part of organized dentistry, but this is not a fact. Though drug addicts have insisted on having teeth extracted in order to get an injection of cocaine, there are no cases on record of members of our profession being convicted for producing abortions by performing dental operations.

It is always well to consult with

Fig. 7.—Hemorrhage about maxillary left molar with roentgenogram of same area in patient with purpura hemorrhagica.

Fig. 8.—Hemorrhage in patient with myelogenous leukemia.

physicians about the dental treatment of pregnant patients. We can assure them that the prevention of toothache alone more than justifies systematic dental attention.

ANEMIA

Another group of patients about whom physicians and dentists should consult are

Fig. 9.—Actinomycosis of tenth and eleventh dorsal vertebrae.

those having anemia. The term "anemia" is applied to any deficiency in the quantity or quality of the blood as manifested by a reduction in the number of red corpuscles, or in the amount of hemoglobin, or in both. This condition is conveniently classified in medical books as acute and chronic secondary anemia, miscellaneous anemia and pernicious anemia.

Secondary anemia is that type which, as a rule, results from some more fundamental disease, such as cancer.

Pernicious anemia is usually considered a definite clinical entity, because of its rather distinct characteristics. It is a grave progressive disease, interrupted by remissions occurring without any discoverable cause. It is characterized by certain changes in the blood and blood-forming organs, in the central nervous system, and in the gastro-intestinal tract. It also presents striking changes in the oral tissues. The mucous membrane becomes pale and almost bloodless. Spongy, bleeding gums are practically never seen. Of course, certain people have pale gums and are not anemic, and some people have anemia with but little oral change, but the majority of patients with pernicious anemia present a characteristic mouth picture. The medical profession believes that because these patients have all they can handle in fighting the anemia, all possible foci of infection should be removed. Also, it is well known that the presence of infection somehow counteracts the beneficial effect of the specific liver treatment so that much more liver or potent liver extract is necessary to produce the same amount of blood response in a person harboring some infection than is needed in a patient who has pernicious anemia without infection. For these and similar reasons, physicians sometimes insist on the extraction of teeth that dentists feel should be retained.

JAUNDICE

Of greater significance than the oral picture of anemia is that seen in the floor of the mouth in jaundice, which is not a disease, but a symptom. It is indicated by a yellowness of the skin and mucous membranes as a result of the presence of

bile in the tissues, the result of obstruction of the bile ducts of the liver or the common bile duct by a gallstone, by inflammation of the ducts or by pressure from a cancer, a tumor or adhesions. Because of the obstruction, the bile is unable to flow into the intestines and is dammed back into the blood stream. It is thus carried to the tissues of the body, giving them a yellow tinge. There are certain parts of the body in which the colors are beautiful. One is the eyeball; another, the floor of the mouth.

Besides our interest in this oral manifestation of jaundice, we are vitally concerned with the fact that the coagulation of the blood of these patients is diminished. Consequently, they bleed more freely and the hemorrhage is more difficult to control than is the case with normal people.

Surgeons do not operate on patients with jaundice except in great emergency. Fortunately for us, these patients are usually too sick to consult a dentist. It would be better if dental operations involving the possibility of bleeding were avoided.

PURPURA HEMORRHAGICA

A still more spectacular mouth manifestation of a general condition is seen in purpura hemorrhagica. Like jaundice, purpura is a symptom. Medical writers use the term to define a number of affections characterized by extravasation of blood into the skin. Under purpura hemorrhagica, they include cases of very severe purpura with hemorrhages from the mucous membranes, especially the nose, mouth and genito-urinary tract, as well as into the skin. The mouth picture resembles that seen in scurvy, from which it may be distinguished by the fact that, in the latter, there is usually a history of dietetic error and the blood platelet count is normal. The oral lesions may be located anywhere in the mouth, but the most common points of bleeding are about the necks of the teeth. Here, the hemorrhage is profuse. The first indication of the presence of this condition may be an excessive hemorrhage following the extraction of a tooth. Since its treatment is general, it is advisable to bear purpura hemorrhagica in mind in cases of bleeding that fail to respond to local measures.

Fig. 10.—Use of dental plaster in preventing leakage during basal metabolism test. (Used for patients unable to hold mouth piece firmly because of loss of some or all of teeth.)

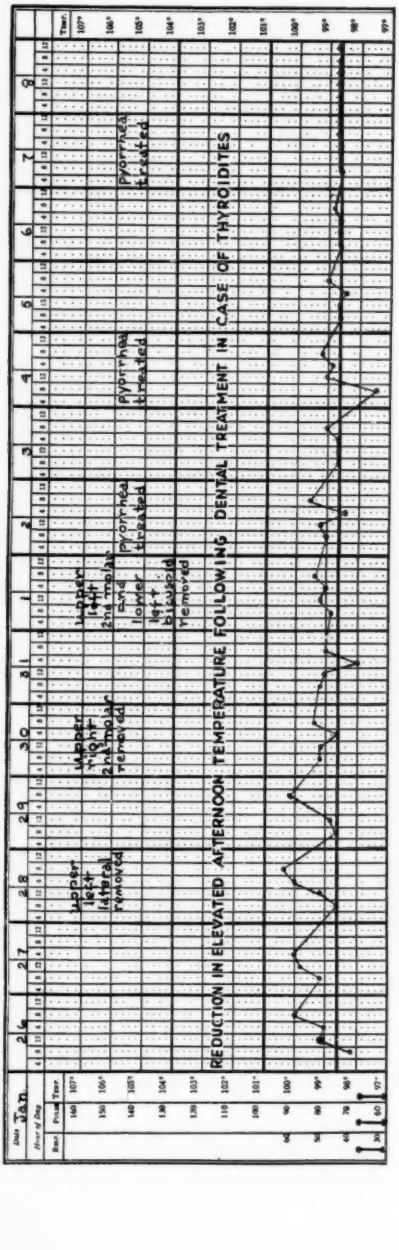
Date Jan
Hour of Day
Rect Pulse Temp
REDUCTION IN ELEVATED AFTERNOON TEMPERATURE FOLLOWING DENTAL TREATMENT IN CASE OF THYROIDITES
Upper right 2nd molar removed
Upper left lateral removed
Upper left 2nd molar and lower left bicuspid removed
Pyorrhea treated
Pyorrhea treated
Pyorrhea treated
Temp.

Fig. 11.—Reduction of elevated afternoon temperature in patient with thyroiditis following dental treatment.

ACTINOMYCOSIS

As we break these medicodental problems into small bits for study and understanding, we find many and varied surprises. The veterinarian joins the physician and dentist in an interest in disease. This is illustrated in a condition known in man as actinomycosis. In cattle, it is called "lumpy jaw."

This disease is caused by the ray fungus, an organism resembling a miniature sycamore ball which produces lesions known histologically as infectious granulomas. It occurs largely among farmers, who are believed to contract it from eating uncooked vegetables or from chewing straws. Some writers insist that it is transmitted from man to man and from man to animals and vice versa; while others are equally positive that it is not. All authors seem to agree that it may be easily confused with tuberculosis.

In more than half of the reported cases, the disease involved the neck and jaws. The first sign in the jaws is a hard lump or swelling in the parotid or maxillary region. The skin becomes elevated and reddened, and small nodules develop which sooner or later soften and break down, discharging serum or seropurulent fish-roelike bodies made up of the fungus and called "sulphur granules." Mixed infections frequently follow. All writers suspect that the disease arises from the mouth, but no writer has yet given a satisfactory explanation of how metastases take place. An early writer, it seems, asserted that it extended by continuity, and others have repeated what he said without question.

The fact that the organisms of this disease are found in decayed teeth and that the disease occurs in the abdomen in 21 per cent of the cases reported, in the chest in 13 per cent, in the tongue in 4 per cent and in the jaws or neck in 52 per cent leads us to believe that they may

travel from decayed teeth by some means yet unknown.

There are on record eight cases of this disease occurring in the spine. A ninth has recently been added by W. T. Graham and his associates, of Richmond, Va. The patient had a primary lesion beneath the lower jaw, which healed after a simple incision and drainage. A few months later, the patient developed pain in the sacro-iliac region. Laboratory findings at this time revealed the presence of the ray fungus in his sputum.

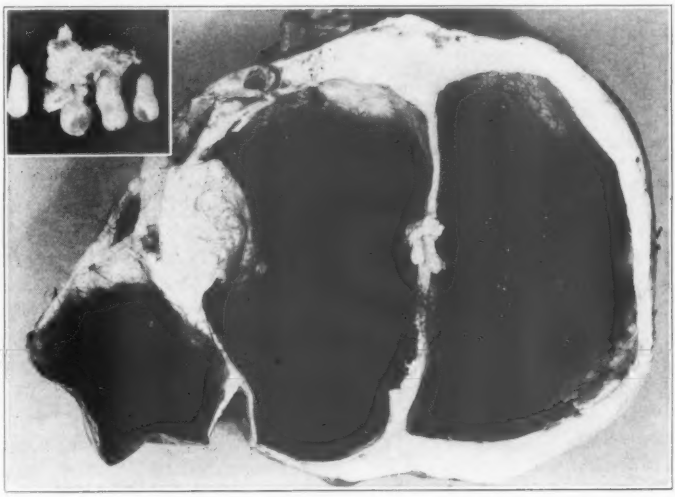

Fig. 12.—Benign tumor of ovary containing teeth.

The roentgen-ray report stated that the patient had actinomycosis of the upper half of the left lung and of the tenth and eleventh dorsal vertebrae. This patient, a dentist practicing in a rural community, may have infected himself with these vegetable parasites from a patient's mouth.

THYROIDITIS

The consideration of structures situated in and about the neck brings to our attention the thyroid gland. Its pathologic changes present a fruitful field for study by our profession. Of these, thyroiditis, or inflammation of the gland, may be selected as a typical example.

This disease is usually classified as simple thyroiditis, suppurative thyroiditis or chronic thyroiditis, each of which is again classified into those primary in the thyroid and those secondary to generalized infection.

It is agreed from clinical observation that over 50 per cent of the cases of simple thyroiditis are associated with preceding infection of the tonsils, pharynx, teeth or upper respiratory tract.

REPORT OF A CASE

A patient was referred to the hospital, Jan. 25, 1933, with a diagnosis of goiter. Another surgeon who saw her in consultation at home suspected malignancy. She had been ill for four weeks, the thyroid being enlarged and tender. There was a slight choking sensation, with difficulty in swallowing. The temperature had been

elevated, usually in the afternoons, to 101 or 102 F. There had been a loss of about 20 pounds in weight. The patient was considerably worried for fear she had tuberculosis, since she had been nursing her husband, who had had this disease for several years. The basal metabolic rate was +24. The general physical, roentgen-ray and laboratory examinations were essentially negative. The dental examination revealed advanced pyorrhea and one so-called "blind" abscess.

Diagnoses considered by the physician were simple thyroiditis, tuberculous thyroiditis and malignancy. It was decided to treat the patient along general conservative lines with rather radical dental therapy. Four teeth were removed and the pyorrhea pockets were laid open so that the inflammatory growths contained therein

Fig. 13.—Application of molding compound appliance for retaining radium in position in mouth.

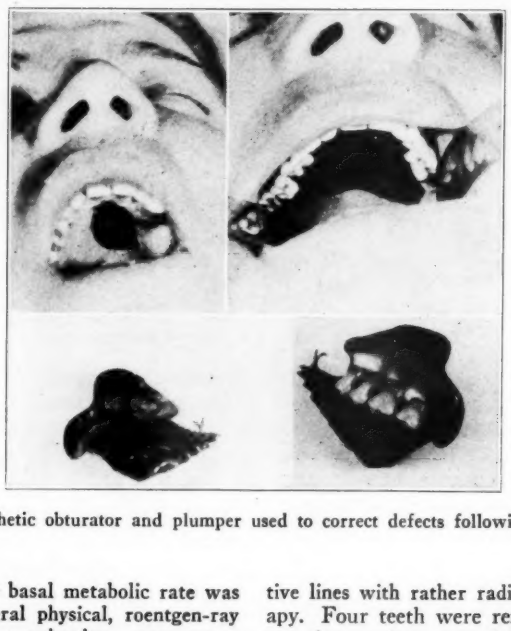

Fig. 14.—Prosthetic obturator and plumper used to correct defects following treatment for cancer.

could be definitely removed. The fever began to subside immediately. The thyroid decreased in size and the tenderness abated. The patient left the hospital thirteen days after admission, with normal temperature and having gained 9 pounds in weight. The basal metabolic rate at the time of discharge was plus seven. At the present time, two and one-half years after the original examination, she is perfectly well.

CANCER

Cancer has been a constant subject of study in all ages and in all nations, but the mystery of its origin is as yet unsolved and resistance to its progress has not yet been successful. Until the cause

Fig. 15.—Cancer.

of cancer is discovered, its treatment must be empiric and unsatisfactory. Among the numerous theories of the etiology of cancer, two stand out most prominently. The first is the germ theory, which attributes the disease to infection with some hitherto undiscovered bacterium, parasite or virus. The second is the cellular theory, which is based on the supposition that, during the development of the fetus, more cells are produced than are utilized and these left over cells remain dormant until they are aroused from their slumber in later life by some irritation or stimulus. As they are embryonal cells, they do not follow the orderly process of development of mature cells. They are "the lesser breed without the law," potential murderers, and their propagation results in the production of a malignant tumor. The cellular theory is strengthened by the fact that when cancer of the breast metastasizes to the liver, the new growth is formed of breast and not of liver cells.

Despite the enormous amount of time and money that has been spent on the study of cancer, we know little more about the disease than we did forty years ago. The man who solves the problem will rank in history with the chemist Pasteur, the surgeon Lister, the physicist Röntgen and the dentist Morton.

Clinical observation of cases of cancer apparently establishes the following facts: The growth begins because of some local irritation such as from the sharp edge of a tooth or the hot stem of a pipe. The disease is at first local and becomes regional and general later by metastases or extension through the lymphatics. It is not contagious because it cannot be reproduced in man by inoculation or implantation, and no case is on record wherein a surgeon or dentist has contracted the disease from contact with a cancer patient. Different patients have different degrees of resistance. In one patient, the growth may extend rapidly and in another an apparently similar growth may remain quiescent for years. The word "resistance" as applied to disease has a very definite meaning; yet it defines the most indefinite and unknown of all bodily activities. In no disease is this more striking than in cancer.

The accepted treatment of cancer is the early and complete removal of the growth with the knife or cautery or by irradiation. The prognosis depends more on the time of the diagnosis than it does on the skill of the surgeon. As cancer is at first a strictly local disease, theoretically there is always a time that it can be

cured. Unfortunately, cancer in the early stages causes no pain, and the patient does not consult a surgeon until it has made considerable progress. It is therefore necessary to remove not only the original focus, but the adjacent lymph nodes as well.

The beneficial or curative effect of irradiation by the roentgen rays or radium is due to the fact that cancer cells have less resistance than normal cells and therefore a skilful radiologist can give a patient a treatment that will kill the cancer cells and not harm the normal cells.

The cancer that most interests the dentist is located in or on the mouth or on the lips, gums, palate, cheek or tongue. Owing to the nature of his work, he has the opportunity to recognize these conditions in their incipiency as well as in their developed form. He can prevent cancer by the proper treatment of precancerous lesions of the lip and the correction of rough edges of the teeth. He can often save the life of a patient by the diagnosis of early cancer and by either personally applying the proper procedure or referring the patient to a more experienced oral surgeon.

CONCLUSION

In the recent report of the curriculum committee of the American Association of Dental Schools, there is a chapter dealing with the need for medical instruction of dental students. It would mean a wider knowledge of general pathology and disease for young men with the dental degree. The next practical step should be the preparation by an authoritative dental group of a comprehensive reference book on clinical medicine for dentists.

The only books available today are written either for physicians, and are long, technical and deficient in the dental phases of practice, or for nurses and are therefore short and elementary. Something between these two will enable us, the dental graduates, to broaden our understanding of the factors in medicodental practice and thereby hasten our contributions toward a rational fulfilment of the promises of dentistry in systemic disease.

BLEEDING FROM THE ORAL TISSUES: CAUSES AND DIFFERENTIATION*

By CARROLL L. BIRCH, M.D., Chicago, Ill.

THERE are many general medical conditions which present mouth lesions as initial symptoms. The average layman seeks the advice of the dentist for all difficulties arising within the buccal cavity. The dentist, therefore, has a grave responsibility. These symptoms vary from the simple aphthous ulcer to gangrenous stomatitis, including a large number of diseases and conditions with almost as many causes.

Stomatitis may be caused directly by trauma, mechanical irritation, the ingestion of acids or alkalis or excessive heat

*Read before the Section on Medical Relations at the Seventy-First Annual Midwinter Clinic of the Chicago Dental Society, Feb. 20, 1935.

or cold. It may also be caused by absorption of mercury, the iodides, the brommides, lead, etc. In the majority of cases, it is microbial in origin. It may exist as an independent infection caused by *B. staphylococcus, streptococcus, pneumococcus, diphtheriae, tuberculosis* or *fusiformis* (with *Borrelia vincentii),* the gonococcus or *Spirochaeta pallida,* or as an accompaniment of a general infection such as scarlatina, measles, typhoid or syphilis. Another cause is vitamin deficiency, such as scurvy. Animal parasites, *Endamoeba gingivalis* and *Trichomonas buccalis* are relatively uncommon causes. Fungus such as *Oidium albicans* of thrush or the ray-fungus of actinomycosis occur but rarely as etiologic factors.

Gangrenous stomatitis occasionally appears in debilitated children during the course of measles or whoopingcough, and in older persons as well, in acute leukemia, agranulocytic angina, etc.

The dentist also sees patients with enlargement of the glands in the neck, which might have arisen from an abscessed tooth. On the other hand, the cause could be tuberculosis, leukemia, Hodgkin's disease (infectious granuloma), carcinoma, branchial cyst, parotitis, etc.

Then there are a large group of patients who visit the dentist because of swollen, red, bleeding gums. The patient, of course, believes that he is one of the famous "four out of five" who have pyorrhea. In many instances, he is right; but, in some instances, he is wrong. Bleeding of the gums is a symptom in a long list of diseases, some of which have been mentioned above; others include hemophilia, purpura hemorrhagica, the acute leukemias, agranulocytic angina, polycythemia and scurvy. In all of these diseases, there is an increased tendency to hemorrhage, and surgical interference is extremely dangerous. The differentiation of these diseases from pyorrhea is not always an easy one. In many instances, it requires a careful history, a complete physical examination and a painstaking study of the blood.

Scurvy, which is usually thought of as the ancient disease of sailors, is not uncommon today. This disease assumed prominence in the latter part of the fifteenth century when a water route to the East Indies was being sought. At this time, sailing vessels took months or even years for a single voyage. The diet of the sailors was practically limited to hardtack and salt pork. In 1495, Vasco da Gama first found a passage to the East Indies by way of the Cape of Good Hope. During this voyage, 100 of his 160 men died of scurvy. In 1535, James Cartier wrote as follows concerning the mouth symptoms of scurvy: "Their mouths became stinking, their gums so rotten that all the flesh came away, even to the roots of their teeth, which last did also almost fall out."

Scurvy also took a heavy toll in every ancient war, in almshouses, in prisons and in asylums. In the Civil War, there were 30,714 cases recorded among the white troops alone. This disease not only affected the ancients, but also exists today, all too often unrecognized. Since the depression, it has become more common.

Scurvy is a deficiency disease caused by the lack of vitamin C, an essential factor in diet. This vitamin is present in large quantities in lemons and oranges and in lesser amounts in limes, grapefruit, other fresh fruits and fresh uncooked vegetables. Drying and prolonged cooking destroy its action, although it is retained in canned tomatoes. Vitamin C has recently been produced in concentrated form under the name of ascorbic acid.

There are three outstanding symptoms of scurvy: 1. The gums become spongy and swollen and bleed frequently, looking like a piece of red plush. 2. Petechial hemorrhages are usually widespread. On the lower extremities, these hemorrhages frequently occur within the hair follicles. There may also be bleeding from the stomach, intestine, kidneys and nose, into the sclerae, etc. 3. Subperiosteal hemorrhages are quite characteristic, as are also hemorrhages deep into the muscles. The patient becomes very weak and anemic.

What part mild scurvy may play in cases of obstinate pyorrhea is a matter for conjecture. The persons in modern life who are most liable to develop scurvy are infants fed solely on condensed milk and the poor who live chiefly on dried beans, bread, potatoes and well cooked meats. Persons, such as farmers, living in isolated districts, may develop scurvy in the spring after living all winter on root crops and salt meat. Another group that is prone to this disease are the young women who diet too strenuously to preserve their waistlines. The Sippy diet used in the treatment of peptic ulcer, may, if continued too long, lead to scurvy.

When the diagnosis of scurvy is established, no surgical measures should be carried out in the mouth until the patient is entirely cured, for two reasons: the danger of hemorrhage, and the advisability of waiting to see whether the condition will disappear on dietary treatment alone.

Polycythemia vera is a rare disease. The face is cyanotic, especially the lips. The tongue and gums are a bluish purple. The eyes are frequently bloodshot. The spleen is enlarged. Hemorrhages are frequent, especially from the nose and gums. The diagnosis is confirmed by an examination of the blood. The hemoglobin is increased to from 150 to 200 per cent. The red blood cells are increased to from 8,000,000 to 12,000,000. The white cells are increased, especially the polymorphonuclear leukocytes, to from 15,000 to 20,000. The number of blood platelets, blood volume and viscosity of the blood are increased. The coagulation time is short.

Although dental surgical measures are not advisable in these cases, and excessive hemorrhages would undoubtedly occur, it would probably not be fatal and might even be beneficial. A more easily controlled blood loss, such as from venesection, would be more advisable.

Agranulocytic angina is a rare disease which is seemingly becoming more common. It was first described by Schultz in 1922. The presenting symptom is usually ulceration of the mouth, chiefly in the tonsillar region. A few cases have been described in which the initial complaint was rectal pain. Here the diagnosis is made by examination of the blood. The white cells are greatly decreased in number, almost entirely at the expense of the granulocytes. The polymorphonuclear neutrophils and eosinophils practically disappear from the circulating blood. This disease is frequently fatal. Except in the rare instances in which a tooth infection might be considered as a possible causative factor, dental interference is contraindicated.

All of the acute leukemias show a decided tendency to hemorrhage, especially from the gums. Patients appear to be quite ill, and chills and fever are common. Anemia develops rapidly and is often extreme. The spleen is usually enlarged. There may be a generalized lymphadenopathy. The diagnosis is frequently made by an examination of the blood, which usually, but not necessarily, shows an increase in the white cells to from 20,000 to 50,000 or higher. A

study of these cells will reveal young forms. The blood platelet count is reduced. The bleeding time is usually prolonged. Sometimes, it is necessary to resort to lymph gland biopsy, bone marrow or splenic puncture in order to establish a diagnosis. The disease is always fatal. Tooth extraction during the course of the disease is frequently followed by a fatal hemorrhage.

The term purpura, meaning purple fish, is derived from the Greek. It was in the sixteenth century applied to all purple eruptions, spotted fever, plague, typhus, cerebrospinal fever, hemorrhagic measles, hemorrhagic smallpox, scurvy, etc.

Purpura is usually considered under two main heads, symptomatic and essential. The symptomatic purpuras are many. Petechial hemorrhages occur in many of the blood diseases (acute leukemia, agranulocytosis, pernicious anemia, aplastic anemia, hemolytic jaundice, Gaucher's disease, etc.), certain infections (endocarditis, typhoid, hemorrhagic scarlet fever), intoxications (benzene, arsphenamine), anaphylactoid reactions (Schönlein and Henoch's purpuras), avitaminosis (scurvy), intoxications (iodide, mercury, snake poisoning), degenerative processes (senile and cachectic states), mechanical (epileptic convulsions, whoopingcough, dropsy), and also in certain endocrine and nervous disorders.

Essential purpura is commonly called purpura hemorrhagica, a term first applied by Willan in 1801. Paul Gottlieb Werlhof's capable dissertation on this disease appeared in the same year. The condition is frequently known as Werlhof's disease.

This disease is characterized clinically by a wide distribution of petechial hemorrhages under the skin, in the mucous membranes and into the conjunctivae. The most outstanding symptom is bleeding. The most common sites are the nose and gums, although they may arise from any part of the body, stomach, intestines, kidneys, lungs, peritoneum, pleura, etc. The spleen is frequently enlarged. The diagnosis depends largely on the examination of the blood. An anemia of secondary type is usually present. The blood platelet count is greatly reduced from 5,000 to 50,000 (normal, from 300,000 to 500,000), the bleeding time is prolonged, the coagulation time is normal and the clot is nonretractile.

Dental surgical procedures are contraindicated in purpura hemorrhagica. If operation is considered an essential factor in the treatment of the disease, a severe hemorrhage should be anticipated and preparations made for blood transfusion if necessary.

Hemophilia, or bleeder's disease, is very old. It was quite definitely described in the Talmud, 2 A.D. The earliest medical reference to it was made by a Dr. Otto, of Philadelphia, in 1803.

The outstanding characteristics of this disease are:

1. Excessive hemorrhage, which may be spontaneous or may follow slight injury. There are many instances of fatal hemorrhages from tooth extraction or from a cut on the lip or finger. Spontaneous hemorrhage may occur from any part of the body, nose, mouth, stomach, intestine, lung, peritoneum, pleura, skin, muscle, bone, brain, eye, etc. The most characteristic location for hemorrhage is into the joints, which produces a condition closely resembling arthritis.

2. The disease occurs only in males.

3. It is nearly always hereditary. It is transmitted as a sex-linked character. Although it is manifest only in males, it is transmitted through the unaffected female. It is never passed from father to son. It is passed from a hemophiliac

through his daughters to 50 per cent of their sons. The ability to transmit hemophilia may pass from mother to daughter to grandson.

4. The blood findings are characteristic. Cytologically, there is no known disease. The blood platelets are normal in number. The outstanding blood finding is the great prolongation of the coagulation time. In the average case, the blood requires from two to five hours to clot (Howell's method). Normal blood by this method clots in from five to ten minutes. In severe cases, a coagulation time of from twelve to twenty-two hours is not uncommon. The clot when formed is retractile. The bleeding time is usually normal. During severe bleeding phases, it may be prolonged.

Of the ninety-eight cases of hemophilia that we have studied, ninety-four gave a history of mouth bleeding, especially from teeth. Of the four who gave no history of buccal bleeding, one was in a boy, aged 6 months when he died of pneumonia. He had no teeth. One was in a 2 year old child, another in a 3 year old, neither of whom have sustained any mouth injury and were not old enough to have lost the deciduous teeth. The fourth patient was 8 years old and has a severe hemophilia. For some unknown reason, he did not give a history of buccal hemorrhage. Most of our patients give a history of many and prolonged hemorrhages at the eruption and especially at the loss of the deciduous teeth. One of these patients remained in bed the greater part of four years because of almost constant hemorrhage during this period.

There are dozens of recorded cases of fatal hemorrhage following tooth extraction and undoubtedly hundreds unrecorded. Tooth extraction probably ranks second only to circumcision as a cause of fatal hemorrhage in hemophilia. The first remembered hemorrhage occurred from the mouth in 20 per cent of these patients.

A hemophiliac is a pathetic sight after the extraction of a tooth. The mouth is filled with blood clots; the tongue is frequently swollen by hemorrhage so that it protrudes from the mouth and becomes dry and black; the entire head becomes swollen and discolored; the eyes are swollen shut because of hemorrhage into the lids, and the discoloration and swelling extend down into the neck with a bag of blood under the chin. Great quantities of blood and saliva drool from the mouth. Part of the blood is swallowed and then vomited. The hemorrhage in the neck causes such pressure that swallowing becomes impossible and breathing difficult. Local interference, such as curetting or packing, serves only to increase the hemorrhage. The odor is most offensive. The temperature may be as high as 104 F. Tooth extraction in severe hemophilia should be avoided at all cost.

Dentists would be well rewarded by having at least a careful blood examination in all cases in which there is a history of bleeding or any hemorrhagic condition of the buccal cavity.

THE TREATMENT OF ACCIDENTS TO ANTERIOR TEETH OF YOUNG PATIENTS*

By WALTER C. McBRIDE, D.D.S., F.A.C.D., Detroit, Mich.

DISCOLORED DECIDUOUS TEETH

IN a children's practice, one observes a great number of cases of darkened or discolored deciduous anterior teeth which evidently are the result of some injury common to babies learning to walk, and are ascribable to the play activities of older children. The color change varies from a yellowish cast to light and darker shades of brown and to light shades of blue, turning to deeper shades of blue if devitalization has been effected. Parental concern over the color of these teeth will at times entail dental consultation, but, in the vast majority of instances, these teeth are observed by the dentist when the patient comes in for other dental care.

The interesting aspect of these discolored teeth is that the condition will very frequently improve of its own accord, similarly to the healing of any bodily injury in the nature of a cut or bruise, without any remedial assistance. In others, though by far the minority, devitalization will occur, followed by infection and fistulous eruption.

Delabarre, in commenting on these conditions, says:

> The violence of the blow often results in an immediate severance of the blood vessels and nerves entering the root end followed by the death of the pulp, and later on by discoloration, many times without any of the common symptoms indicating the usual abscess formation. The discoloration is sufficient evidence in itself upon which to base a diagnosis of devitalization, even if a negative roentgenogram seems to contradict it. . . . As to treatment, I always lean to extraction as the only positive means of controlling the infection, because of the primary necessity of doing so, coupled with the uncertainty of its elimination by root canal therapy. An added reason for extraction is the interference with the natural process of root resorption which, in turn, may interfere with the proper eruption of the permanent successor. The argument for extraction of nonvital teeth is strongest when applied to the incisor region because there is taking place a natural lateral growth which is not dependent upon the presence of the deciduous incisors.

Bunting, on being interrogated regarding these teeth, mentions his inexperience in children's dentistry, and goes on to say:

> Theoretically it might be possible that if a blow occurred on the tooth, a hemorrhage in the enlarged deciduous pulp might follow and there might be extravasation of blood elements out into the dentinal tubuli. Later, these might undergo disintegration changes with the formation of hematoidin and hemosiderin, decomposition products of hemoglobin, which would give color to the dentin. This is a possibility and probably is the answer to your question, but I have no actual information to that effect.

Kronfeld goes a bit farther in his explanation of the pathologic process, but

*Read before the Section on Preventive Dentistry, Children's Dentistry and Mouth Hygiene at the Seventy-First Annual Midwinter Clinic of the Chicago Dental Society, Feb. 17, 1935.

makes no recommendations as to treatment. He says:

A discoloration of a tooth following a blow or other traumatic injury indicates that some hemorrhages have taken place in the pulp tissue and that some of the blood pigment has diffused into the dentinal tubules. As a result, the dentin becomes yellowish, reddish, or a similar color, and, because of the transparency of the enamel, the tooth appears discolored. Following this hemorrhage, two things are possible: The pulp may die and become decomposed; then the discoloration usually gets progressively worse because of the penetration of the dentin by putrid material. Or the pulp may survive the trauma and may recover; then the hemorrhage in the pulp is gradually absorbed; and with it some or most of the blood pigment that has entered the dentin may disappear. The whole process is then analogous to what happens in the skin following a bruise ("black or blue spot"): First there is a subcutaneous hematoma. This is gradually absorbed, during which time it becomes lighter and lighter in appearance through the overlying skin, until, after a period of weeks or months, normalcy is restored.

Again, to follow my own clinical observations, and to follow the conclusions of Dr. Kronfeld, many of these teeth survive the injury, and health and normal color are restored. If devitalization is affected, it has been my observation that, if the patient comes in at the time of the initial fistulous eruption or swelling, before the destruction of tissue is too great, a large percentage of these teeth can be maintained by treatment. By treatment, I refer not to a long series of appointments, but to one or two medications, following the initial appointment when drainage is established. It is very evident to one who treats children that deciduous teeth, with large pulp chambers and straight canals providing accessibility to the apical portion, either respond immediately or do not respond at all.

The remedial care of such teeth amounts to a treatment of beechwood creosote, followed from four to six days later by canal instrumentation and a second and similar treatment, and, a week later, a root canal filling of sufficient rapidity of setting and hardness to seal the more or less large apical opening. Pulp sealer mixed with a solution of glycerine and iodine (1 ounce of glycerine and 12 grains of iodine) answers such a purpose advantageously.

The distressing factor in the treatment and filling of these teeth is that such treatment not only does not eradicate the discoloration, but, in some instances, increases it.

Clinically, in these cases, I make a roentgen-ray examination to ascertain the condition of the root end and the surrounding tissues. If the attachment and bone tissue appear normal, the tooth is left as it is, the parent being instructed as to the reason for discoloration, the present condition of the tooth and what may be expected of it in the future. On the other hand, if devitalization has been effected, the tooth is either opened for drainage and future treatment or extracted, according to the degree of infection or tissue necrosis. Another factor of importance in deciding whether to treat or extract an infected tooth is, of course, the age of the child and the consequent possibility of shifting of the adjacent teeth.

FRACTURES AND LOOSENING OF DECIDUOUS TEETH

More violent casualties than those causing discoloration of the teeth involve fractures of teeth, fracture of the process and forcing the teeth rootward into the process.

Diagonal fractures of the crown involving only a small angle are most commonly seen. The supporting structure of

the deciduous teeth is so pliant that blows or impacts involving the body of the crown of a tooth result more often in injury or fracture of the process than fracture of the tooth. If there is no pulpal involvement, the rough enamel margin can be disked smooth and the tooth left so. If the pulp is involved, pulp removal under a general anesthetic, with future filling of the canal, can be quite satisfactorily done. If the accident occurs after resorption, extraction is indicated. The occasional longitudinal fracture, extending directly from crown to midsection or crown to root-end, requires extraction as well.

It has been my observation that, contrary to general opinion, teeth so treated exfoliate earlier than normal teeth and therefore do not interrupt or delay the eruption of the permanent successor.

Instead of fracturing the tooth, some impacts, as mentioned above, will fracture the environmental process so that, on examination, a portion of the process will be mobile, though held in proximity by the oral membrane and underlying tissue. If the patient is seen directly after the accident, the buccal or lingual plate, as the case may be, can very frequently be forced back into position *en masse,* and, unless completely detached, will unite and secure the tooth or teeth.

In the same fashion, teeth forced into a lingual or buccal position, only bruising or crushing of the process resulting, can be directed back into quite normal placement by digital application. At times, securing the teeth with an appliance may be necessary. It is true that such appliances cannot be very neatly made because of the mobility of the teeth and soreness of the supporting tissues, but the period of retention is not sufficiently long to work any great hardship.

If the tooth or teeth are forced rootward into the process (as is common to children of 1 to 3 years of age), the treatment, temporarily at least, seems to be a matter of watchful waiting. I have had three such instances, in each of which the parent informed me that the teeth had been knocked out and lost. The roentgen rays revealed the teeth present but obscured from view partly by the inflammation of the tissues and partly by the thrust into the process. In these instances, the tooth or teeth will exfoliate in part as the healing process ensues. Much of the apparent exfoliation is brought about by the recession of the gum tissue in healing. Endeavoring to bring such teeth into alinement incisally would, because of the funnel-shaped, enlarged and newly formed sockets, involve their loss.

The possibility of pulpal death is always a timely consideration in such cases and this information should be imparted to the parent. It has been my experience that six or eight weeks is required for devitalization of a tooth and infectious involvement.

LOST DECIDUOUS TEETH

In the event deciduous anterior teeth are lost, the possibility of shifting of the adjacent teeth, as well as the matter of esthetics and phonetics, becomes a pertinent consideration.

Orthodontic opinion seems to be that in a large number of cases of extraction of the anterior teeth, there would be a larger number of cases wherein there would be no shifting than wherein shifting was evident. That does not modify the fact that the possibility of shifting is much greater at the age of 2 or 3 years than at 5 or 6. Observation over a period of from six months to a year will convince one of the need or lack of need for spacing appliances.

If spacing is indicated, simple band and loop spacers or onlays with retaining

wires seem most adaptable to the first dentition. In either instance, the fact must be observed that it is very difficult to apply spacing appliances on children under 2½ years.

When appearance and phonetics are factors of most concern, perhaps the most adaptable substitution for the loss of the two upper central incisors is the Willet anterior bridge, a bridge which uses for its abutment the lateral and cuspid on either side and which is separated between the central incisors. Thus, it resembles more or less two separate bridges. It is exceedingly difficult to use a partial upper denture with very young children because of the closeness of the bite in this region, which, in itself, precludes the use of vulcanite, and because of the difficulty of retention with newly erupted deciduous molars.

FRACTURED AND LOST PERMANENT ANTERIOR TEETH

In considering fractured and lost permanent anterior teeth, one must visualize four distinct pictures or conditions:

1. Those teeth presenting diagonal fractures without pulpal involvement, but with the pulp sufficiently close that it shows pink through the dentin. In many instances, the pulp will not be evident, yet the fracture will be sufficiently close that protection will be indicated.
2. Those with lateral fracture with pulpal involvement.
3. Devitalized teeth.
4. Lost teeth.

A very obvious factor in these accidents is that they most frequently occur to newly erupted teeth about the seventh to ninth year, at which time the apical end of the tooth is still open and incomplete. Consequently, routine root canal procedure cannot be instituted and other measures must be employed if the pulp tissue is very greatly affected. For all future considerations in this paper, you will please have in mind that the patient under consideration in every instance is a child of from 7 to 9 years.

To replace a lost tooth, or to treat and restore a fractured anterior tooth after adolescence, is a comparatively simple procedure, requiring but a few days to renew the patient's masticating and speech functions and general appearance. But to do the same for a child during the developmental period—during the years of tooth exfoliation and general alining of the teeth—is an entirely different problem.

Take, for example, the case of a lateral fracture involving the pulp. In a mature person, under infiltration or block anesthesia, the pulp could be removed, the canal filled and the preparation made for a jacket crown in a single appointment or at least two appointments, and the jacket placed at another appointment. From two to five days would be the greatest length of functional and esthetic inconvenience to the patient. If it were a case of extraction, a bridge attachment could be made on the adjacent teeth at once and a bridge be placed in a similar length of time.

With young patients, there is the matter of tooth alinement. Many of these newly erupted permanent teeth are crowded, overlapping and protruding, and restorations can be made only with great difficulty. In a child of from 7 to 9 years, the apical third of the central incisor is not formed (the lateral is not completed until two years later) and satisfactory or permanent root canal work cannot be accomplished. If extraction is indicated, the problem of using the lateral incisors for bridge abutments is questionable. Then too, these accidents frequently occur when the neighboring teeth have not yet erupted or are only partially erupted and therefore cannot be con-

sidered in any fashion other than in that light in which, by virtue of their absence or only partial eruption, any restoration one may make will stand out like a sore thumb.

If the fracture does not involve the pulp, and a porcelain inlay or jacket is desired, one is again handicapped by the inability to sufficiently cut the tooth without the possibility of pulpal irritation and death. In general, these are the formative years, and any restoration or appliance must be constructed in such fashion that nature's plan of growth and development will not be altered or inconvenienced.

Therefore, whatever one does or attempts to do must be cataloged under temporary work, and the parent informed that this must suffice until the patient is from 15 to 18 years of age. And, with pride-acquiring boys of 12 years, with vain girls of the same age and with proud and socially inclined parents, this is a task.

I make it a practice to voice my own attitude in advance of the parent's, saying, along with other explanations, "This temporary restoration will not please you —it doesn't please me—but, all things considered—the age, tooth development, eruption and the maintenance of vitality —this is the most adaptable substitution. If you can be a little tolerant until the boy is through these formative years, I can restore the tooth to nearly normal appearance, to your satisfaction and mine."

There are several common varieties of anterior fractures including (*a*) lateral, (*b*) central lobe, (*c*) longitudinal, terminating in the canal or well below the gum margin, (*d*) multiple lateral, (*e*) double angle, (*f*) diagonal, involving the pulps and, finally, (*g*) the classic, as I see it, the one most generally prevalent with a large diagonal fracture on one tooth either involving the pulpal horn or dangerously close to it, and a small portion of the mesio-incisal tip on the other.

The first consideration in the treatment of any of these conditions is a roentgen-ray examination, primarily to ascertain the possibility of root fracture; secondly, to learn the proximity of the horn of the pulp to the line of fracture, and, thirdly, to observe the apical development. If the fracture is slight and there is sufficient protection to the pulp, merely disking the rough edges and reducing the sharp angles will suffice. Along with the general comment regarding any type of fracture should be added the admonition that any blow may so injure the tooth or break the pulpal filaments at the apical opening that it eventually becomes pulpless and infected. The roentgenogram will show no evidence of such condition now. If this is true, temporary pulpal protection or lack of it will have little or no bearing on the end-result. Evidence of such devitalization and infection will occur in the form of pain and inflammation about the tooth and in a period of from six to eight weeks. If the pulp area shows pink through the dentin or the line of fracture is sufficiently close that pulpal protection is indicated, I cover the tooth with a celluloid form filled with a paste of zinc oxide and eugenol and dismiss the patient. Usually, these children come in without appointments, when one is occupied with other patients, and this procedure provides a simple and satisfactory emergency service. An appointment is made after the inflammation has subsided and when time is available to construct a restoration.

I have heard many operators mention their difficulty in using a crown, saying that if there was too much of the filling material and cementing medium, the form would break, and, if too little, air spaces appeared in the filling. This can be remedied by heating an explorer and

thrusting it, when hot, through the celluloid form at the proper angles, thus making two openings on the incisal edge. Care must be exercised not to make the opening while the explorer is red hot because of the inflammability of the crowns. These openings will permit the air and excess filling material to escape as the crown is being forced to place.

In general, I have been making two types of temporary restorations, one of which involves fitting an orthodontic band securely to the tooth in such fashion that it covers about one-half the fractured portion. It is cemented to place with cement or "kryptex." After the pulpal area is sterilized with an essential oil derivative, such as eugenol, and is covered with a pulp capping material, either kryptex or synthetic porcelain is added to build out the proximo-incisal edge. Completed, this restoration resembles a tooth supporting a band for orthodontic appliances and is, therefore, well within the current fashions for young persons.

The other restoration common to my practice involves use of a slipper crown or onlay. The only preparation is disking away the contact points of the tooth, providing retention by bringing the metal slightly over on the buccal angle of the tooth. In taking the impression, I use a crown filled with synthetic porcelain and place it on the tooth, thus replacing the fractured portion, and trim to conformity with the tooth surface, leaving the proximal aspect with sufficient clearance for 30-gage wax. The impression is taken with compound and a copper band and an alloy model is made. The porcelain angle will adhere to the impression as it is removed from the tooth, but it can be easily withdrawn with an explorer or very carefully removed with an inverted cone bur.

Pink 30-gage wax carried well down to or under the gingival margin, just slightly over the incisal edge and slightly over on the buccal surface in the proximal region, and then cast in hard gold, constitutes the material used. The crown is set with light ceramic cement and the angle filled with synthetic porcelain.

The disadvantage of such porcelain windows is the difficulty in selecting the proper shade and the darkening of the filling material after insertion. The gold backing gives a certain color refraction to the filling material that it is difficult to judge. Cutting a window in the lingual surface of the onlay will aid in the color refraction of the silicate. Someone has suggested that painting the inside of the crown before inserting the porcelain might reduce this color effect, but thus far, because of the setting time of even fast setting paints, I have not attempted it.

This same restoration may be used to replace the whole incisal edge of a tooth as well.

To refer again to the second dentition: One sees a great many fractures involving the pulp in which the latter is protruding from the chamber when the patient comes in. Again, as previously, roentgen-ray examination is made to determine the possibility of root fracture, as well as the progress of apical development.

If the patient comes in immediately after the accident; i. e., within twenty-four hours, a pulpotomy is indicated. If more time has elapsed, there is a possibility of the tissue's being infected, and extraction is in order.

Pulpotomy refers to a partial removal of the pulp tissue. It is done with the thought that the remaining portion of the pulp will continue to live and complete the apical formation of the tooth. In this procedure, under a general anesthetic, or with conduction anesthesia, the pulp chamber is opened and made accessible with large cross-cut burs. Next, the

bulbous portion of the pulp is removed with a large round or surgical bur. The size of the surgical or round bur can be determined with the aid of the roentgen rays, one being selected to fit the canal where convergence of the walls begins, which is just beyond the bulbous portion, or about 2 mm. rootward from the line of the gum margin.

The hemorrhage is controlled with hydrogen peroxide and phenol, and all portions of the clot should be carefully removed. The stump is cauterized with a hot plugger and again washed with hydrogen peroxide. A thin mix of a paste made from "sealer" powder and a glycero-iodine solution is flowed into the chamber, over the denuded vital pulp stump, and it is sealed with cement without pressure.

The tooth may be left so for a few months' rest period, or the incisal portion may be built up with porcelain at once, using a form, provided sufficient bulk and retention can be gained in the crown portion of the tooth and the whole foreshortened to relieve the masticatory stress. Or the tooth may be immediately restored with an onlay and silicate window, to be replaced, like the former restoration, at from 14 to 18 years, with a jacket crown.

On the other hand, if the child is a little older—say, 8½ to 9½ years—and the apical end of the root is formed to the extent that the diameter of the opening is not greater than the diameter of the largest guttapercha points, complete devitalization, with filling of the canal, may be subsituted for extraction. Such a procedure, of course, is to be followed by root resection. Many men have had excellent results with this treatment. If root resection is not anticipated, this procedure should be undertaken with the idea firmly in mind, and firmly fixed in the mind of the patient and parent, that it is only a temporary measure at best—a measure to keep the tooth temporarily, thus delaying until some more suitable time the prospect of extraction and bridge substitution.

When one or more teeth are lost during this period, the matter of temporary substitution is of primary concern. Permanent substitution, in the form of a three-quarters or removable bridge can be provided when the child is midway in the teens.

At the approximate age of from 7 to 9 years, when the adjacent teeth are frequently unerupted, or partially erupted, one has great difficulty in fixing or stabilizing a temporary prosthesis. On the surface, partial or full vulcanite dentures of the commonly called "horseshoe" type, supplying the one or two missing teeth, appear most adaptable. But there are many mouths at this age wherein the bite, in the anterior region, is so close as to preclude any possibility of using vulcanite. It is very common, in the case of protrusion of the upper anterior teeth, to find the lower anterior teeth biting into the tissue distad from the upper teeth, sometimes only to the point of tissue indentation, but, at times, to the extent of irritation and inflammation. Further, the eruption of any adjacent teeth, with accompanying congestion and fullness of the tissue, has a detrimental influence on the degree of comfort with which one can wear a denture. It is my impression that if vulcanite dentures are to be used, some sort of retention in the form of clasps or a crib should be carried out in the molar region.

In my practice, in which I see from four to six fractures of one degree or another per month, I have had but one instance wherein a vulcanite denture was indicated, and the patient rebelled at having anything in the palate. I am aware that any one individual's observation does

not provide a criterion, mentioning this only in passing.

As a substitute for the full or partial palate dentures, I have used simple space retainers, placing them immediately if the adjacent teeth were only partly erupted, or placing them after the appearance of the then unerupted teeth. These spacers, of course, are placed to serve only until the adjacent teeth have fully erupted.

When the adjacent teeth are fully erupted, and especially if only one tooth is missing, I have had success with a so-called orthodontic bridge. It is constructed by fitting two bands made of orthodontic band material, or plate gold if you wish, to the abutment teeth, connecting the two by soldering a 30-gage orthodontic arch wire to the lingual surfaces and soldering to this connecting wire the backing of a pontic tooth. Such an appliance should be subjected to regular and periodic inspection because of the possibility of disintegration of the cement with the resultant harboring of débris and the inception of caries.

When the child is a little older, at approximately 11 to 12 years, at which time the apical development of the lateral incisors is complete and the cuspids have erupted, an onlay bridge may be attached to the two lateral incisors or to one lateral and a central incisor. In a mouth of normal development, without any crowding of the anterior teeth and with a bite that is not too close, such a bridge may be inserted one or two years earlier. As the majority of my patients leave me at from 12 to 14 years, I do not have an opportunity to restore these fractured or lost teeth permanently, but, if I were to do so, I would undoubtedly choose between a three-quarters crown bridge and a cast removable.

Here I would like to modify my personal opinions and choice of treatments and restorations with a cross-section of opinion secured by the Children's Section of the Detroit Clinic Club two years ago.

At that time, in a survey to determine just what was being done in the case of fractures and lost anterior teeth in young patients, 125 questionnaires were sent to pedodontists, orthodontists and others interested in the care of children's teeth throughout the United States. Sixty-one replies were received, forty-five of which were used to tabulate the findings, the remainder being courtesy replies from men who were not then actively engaged in operative pursuits.

In brief, the questionnaire read as follows:

What is your method of treatment and restoration of the following cases:

1. Child, 8 years, maxillary central incisor, diagonal fracture, not involving the pulp, but close enough that the pulp shows pink through the dentin.

2. Child, 8 years, maxillary central incisor, lateral fracture, with incisal one-half lost, desensitized pulp protruding from the tooth.

3. Child, 8 years: (a) one maxillary central incisor lost, (b) two maxillary central incisors lost.

While the age was definitely stated, the thought in general concerned children from 7 to 11 years, prior to complete apical formation. For uniformity, it was assumed that conditions in general, i.e., the child's physical condition and the parents' financial condition, together with the wishes of the parents, indicated treatment and restoration.

Treatment of Case 1: All suggested or intimated the use of the roentgen-ray examination to show proximity of the horn of the pulp to the line of fracture, the apical development and the possibility of root fracture.

All advised covering the pulpal area with a sedative for a brief time while the tissue swelling and soreness subsided;

then to cover the sedative with cement or silicate held in place by means of one of the temporary restorations listed below.

RESTORATIONS SUGGESTED FOR CASE 1

The following means of restoration were suggested for Case 1:

Temporary: Caulk's form with medicement.

Caulk's form with zinc oxide and eugenol paste.

Caulk's form with pulp capping, covered with kryptex or silicate.

Gold band, incisal edge soldered.

Orthodontic band with incisal edge soldered.

Orthodontic band with guttapercha.

Gold shell crown.

Cap crown.

Three-quarter cast crown, gold or porcelain incisal tip.

Gold inlay.

Gold inlay with porcelain window.

Three-quarter onlay with cervical lip extension.

Three-quarter onlay with buccal lip extension.

Permanent: Gold inlay hollowed for pulp capping.

Veneered gold inlay.

Porcelain inlay.

Porcelain jacket crown.

Gold inlay with porcelain window.

Shell crown.

MODEL SHOWING RESTORATIONS, CASE 1

The following were suggested for models showing restorations for Case 1:

Caulk's form with zinc oxide and eugenol or porcelain.

Gold band with incisal edge soldered.

Cap crown.

Onlay with buccal clasps and porcelain angle.

Gold inlay hollowed for capping.

Orthodontic band with porcelain angle.

TREATMENT FOR CASE 2

For treatment of Case 2 all suggested or intimated the use of the roentgen-ray examination to determine the apical condition and the possibility of root fracture.

Five advised covering the pulp in an attempt to maintain its vitality.

Five suggested immediate extraction.

Twelve suggested pulpotomy.

Twenty-two suggested devitalization.

RESTORATIONS SUGGESTED FOR CASE 2

The following were suggested for restoration of Case 2:

Temporary: Caulk's form with sedative treatment.

Caulk's form with kryptex or silicate.

Copper band with cement.

Gold band with cement.

Orthodontic band with kryptex or silicate.

Shallow three-quarter crown onlay with silicate window.

Three-quarter crown or pinledge with porcelain window.

Open face crown with porcelain window.

Post inlay with porcelain window.

Post inlay, all gold.

Swaged platinum or gold cap.

Gold inlay with porcelain window.

Permanent: Cast gold thimble and jacket crown.

Davis crown.

Gold shell crown.

Three-quarter porcelain jacket crown.

Porcelain jacket crown.

MODELS SHOWING RESTORATIONS, CASE 2

The following were suggested for models showing restorations in Case 2:

Incisal tip inlay.

Three-quarter jacket crown.

Jacket crown.

Post inlay.

Open face crown.

Davis crown.

RESTORATIONS SUGGESTED FOR CASE 3

The following were suggested for restoration of Case 3:

Temporary: Full palate denture.
Partial denture with clasps.
Partial denture without clasps.
Partial denture with Crozat crib clasps.
Horseshoe spring denture.
Gold saddle denture.
Vydon partial denture.
Removable bridge.
Hawley retainer.
Orthodontic bridge (bands on abutment teeth with pontic).
Mediodistal grip clasps for central incisor with pontic attached.
Lingual arch supporting missing teeth.
Lingual arch space maintainer.
Band and loop space maintainer.
Gold crowns on deciduous cuspids supporting gold saddle, with central incisors.

Permanent: Fixed three-quarter crown bridge.
Removable bridge.

MODELS SHOWING RESTORATIONS, CASE 3

For models showing restorations, Case 3, the following were suggested:

Horseshoe denture without clasps.
Horseshoe denture with clasps.
Full denture with clasps.
Vydon denture with clasps.
Vulcanite denture with clasps.
Gold removable denture.
Lingual bar with retention spurs.
Lingual bar with pontics attached.

OBSERVATIONS ON PRECOLUMBIAN INDIAN SKULLS UNEARTHED IN NEW YORK STATE*

By H. JOBE SEDWICK, D.D.S., Rochester, N. Y.

THROUGH the courtesy of Arthur C. Parker, director of the Rochester Museum of Arts and Sciences, I have been able to examine all of the early Indian craniums unearthed by museum expeditions in New York State during the past decade. The skulls gave evidence of almost every type of dental disease known to modern civilization. This fact was thought to be of sufficient value to record. Hence, observations were undertaken on those precolumbian Indian craniums which have been unearthed in New York State by the museum and which were sufficiently well preserved to be examined properly.

General observations on the craniums were made first, and then the teeth were examined with the naked eye. In this examination, a fine explorer and scaler were used. The scaler was used to free the teeth from any possible coating so that their protective covering might be examined for any defects. The explorer was used to aid in determining the presence and extent of dental caries. These observations, along with those made on the paradental bone, were recorded, and photographs were made of interesting

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*Read before the Section on Therapeutics, Pathology and Research at the Seventy-First Annual Midwinter Clinic of the Chicago Dental Society, Feb. 21, 1935.

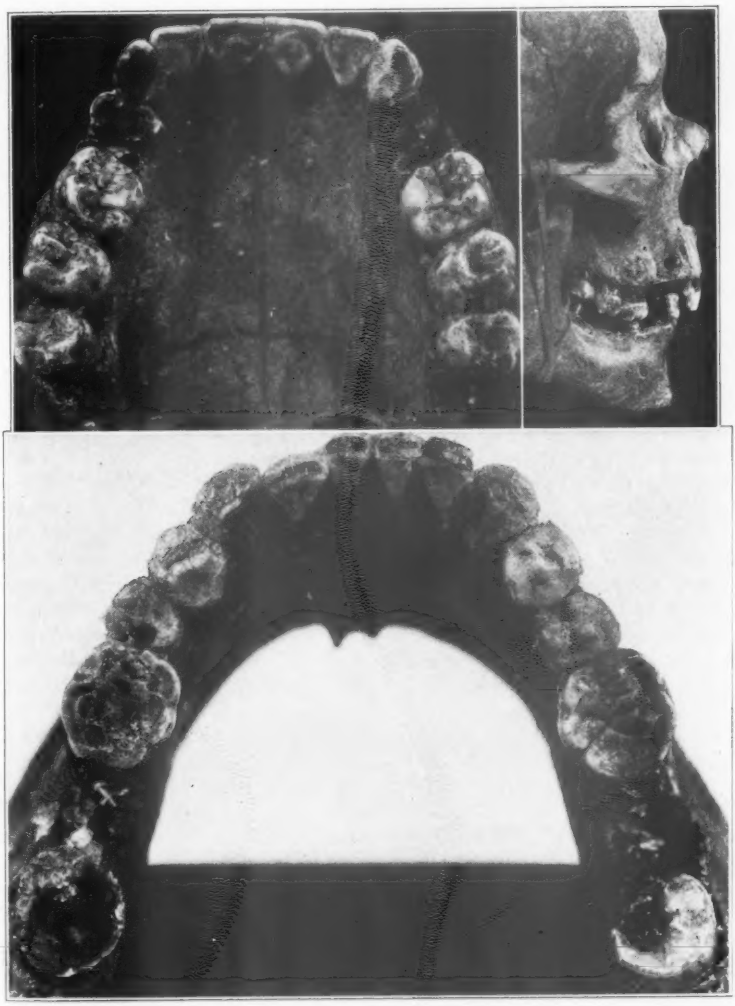

Fig. 1.—Above: Left: Upper jaw showing first degree attrition, with nearly square palate, caries and shovel-shaped incisors. Right: Skull showing enfoliation of the upper right first and second molars, hypoplasia, caries, abscess and so-called pug nose, associated with nearly square palate. Below: Lower jaw showing second degree attrition, with caries, and molars with six cusps.

conditions as found. An attempt to transilluminate the maxillary sinuses was also made, in order to establish the teeth in relation to the floor of the sinus; but this attempt was abandoned because, in most cases, the light failed to penetrate the

bone, presumably on account of its impregnation with mineral salts. The sinuses were roentgenographed and the report appears in the *American Journal of Roentgenology and Radium Therapy*.

The teeth have been numbered from the median line backward on either side above and below according to the following formula and may be referred to in that manner.

Right	Left
8-7-6-5-4-3-2-1	1-2-3-4-5-6-7-8
8-7-6-5-4-3-2-1	1-2-3-4-5-6-7-8

The face was usually symmetrical, the forehead rather low, medium in width and slightly sloping. The nasion depression was on the whole not very pronounced. In most instances, the nasal bridge was medium in height and the nasal bones were medium or wide. Generally, the lateral axis of the orbits was horizontal and the canine fossa fairly shallow. The supra-orbital ridges were medium or prominent and the malar bones medium or heavy. The lower jaw was moderately or well developed and the chin mostly round. From skulls discovered in an Indian village site near Madisonville, Ohio, Hooten found the same type of mandible. The palate was well formed and usually elliptic; the rugosities were slight, and the arches were well developed, the upper having a medium slant. The vault was regular; the sagittal region usually oval; the tempoparietal somewhat bulging or flat, and the prominence of the occiput medium and slightly asymmetrical. The sutures of the skull were medium or submedium, the coronal suture being closed in one case and in two others partially closed. The same was true of the lambdoid suture; whereas, the sagittal suture was in two cases closed, and but one skull presented a transverse occipital and a metopic suture. In five skulls, one wormian bone was found. In six others, two were found; in one other, three; in six others, four, and in another, eight. One skull, moreover, showed an interparietal bone. The mastoids were medium or large and the glenoid fossae medium in size. In about one third of the skulls, a flattening at the occipitoparietal region was noticeable. One skull and many of the other bones of the skeleton seemed to give evidence of myeloma. (Ritchie.) Five skulls had the so-called typical pug nose and with each went an almost square palate.

Usually, the teeth were broad, the anterior teeth presenting well developed marginal ridges between which was a somewhat irregular concave lingual fossa. This form seems to be a general characteristic of the American Indian and is described by Hrdlicka under shovel shaped teeth. Arnborg notes that in some of the oldest human skeletal remains found in Denmark, certain of the front teeth are typically shovel shaped; while Shaw finds that in the Bantu races of South Africa shovel shaped incisors are rare.

In my material, no supernumerary teeth were found; neither were any syphilitic lesions of the teeth noted.

One young child showed enamel nodules of fair size above the medial buccal roots of all the deciduous first molars, a condition which, as suggested by Leigh, may result from ameloblasts which have been detached from the enamel organ.

There were four cases, one involving an upper cuspid and three involving lower cuspids, in which the median lingual ridge was absent, and, in its place, a longitudinal groove was present. Two cases of lower incisors, one a central and the other a lateral, had a median ridge, on either side of which was a longitudinal groove on the lingual sur-

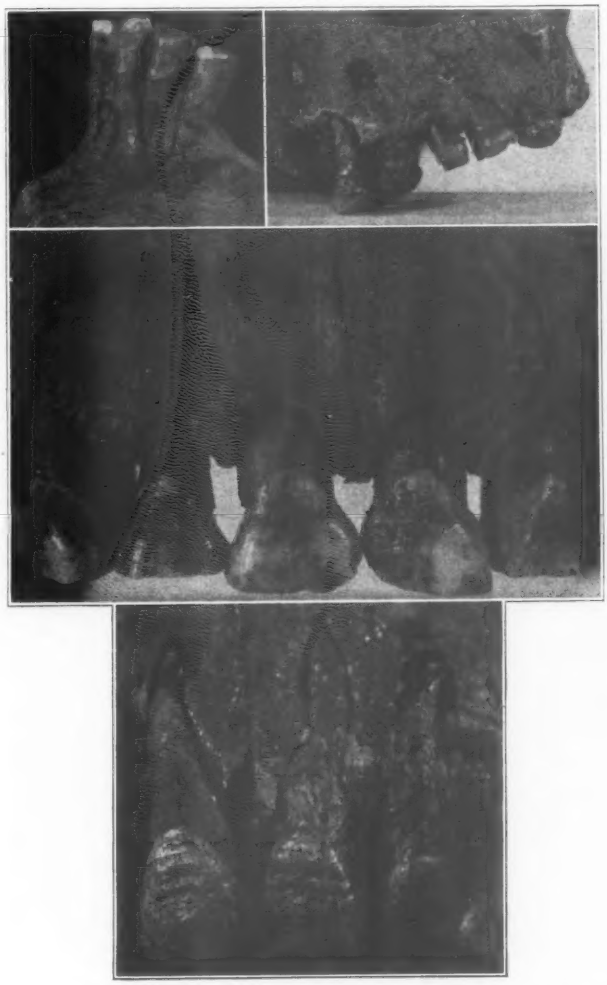

Fig. 2.—Above: Left: Third degree attrition, deposits and alveoclasia. Right: Fourth degree attrition, caries and abscess of upper right cuspid and alveoclasia. Center: Long rooted teeth, with abscess of the upper right central incisor and alveoclasia. Below: Hypoplasia and destructive abscess of upper left lateral incisor.

face. Hrdlicka has described these conditions in his studies on tooth morphology.

In two skulls, the mental foramen was located between the roots of the first molar.

One mandible presented a very low ramus. The distance from the inferior

border of the body to the incisal edge of the central incisors was 38 mm., while that from the angle to the condyle was only 40 mm.

Three cases of malocclusion were noted, a relatively low proportion. Hellman says that the American Indian shows the lowest percentage of malocclusion as contrasted with the Hindus, the Australian aborigines and the Eskimos, the last of whom show the highest percentage. Leigh notes over 11 per cent of malocclusion in the Eskimo. McKay, in his study of malocclusion of the North American Indians, finds that the early tribes have no malocclusion and that malocclusion appears only as they approach civilization. Fischer, in his study of 285 prehistoric Indians of Wisconsin, reports malocclusion in 5 per cent, and Leigh, in prehistoric Guam, records malocclusion in 15 per cent of cases.

Attrition was perhaps the most common dental lesion found. In varying degrees, it occurred in all cases. According to Leigh, attrition is the gradual wearing away of the hard parts of the teeth through the physical and physiologic agencies of mastication of food. It is classified by degree as follows: first degree, that stage of wear in which the enamel of the cusps is worn without exposing the underlying dentin; second degree, obliteration of the cusps with partial exposure of the dentin but with enamel still showing at the bottom of the grooves; third degree, the stage at which the tooth has been considerably shortened, exposure even approaching the neck, and the dentin being completely exposed; fourth degree, attrition which exposes the pulp. Leigh's classification has been used in this study. The deciduous teeth of the two child skulls examined also showed attrition of the first and second degree. Such universal wear of the teeth may have been due partially to the developmental defects of the enamel, which was probably of subnormal density, and thus less able to resist the wear of the stone dust, which must have entered freely into the ground maize during its preparation for consumption on the grinding stone. Speaking of the defects of the enamel of the teeth of ancient American Indians, Bödecker says that the force of mastication of gritty food must have been considerable, judging from the degree of abrasion, and that this force was far beyond anything seen today in the teeth of civilized man. The eating of sand-covered berries, the chewing of hides during the process of tanning and the common use of the teeth as a vise, together with the eating of clay impregnated with sand as a form of tonic, undoubtedly must have played a large part in the process of grinding off the tooth surfaces. Leigh says that attrition together with its pernicious sequelae is the conspicuous dental lesion of the California aborigine. In speaking of the teeth of ancient Egyptians, Sir Armand Ruffer states that attrition was very marked and that it probably played a considerable part in favoring the entrance of the micro-organisms of suppuration. Here it seems that both caries and attrition take an equal part in the process. Moodie finds a considerable degree of attrition in the skulls of the prehistoricc Indians which he examined in California. Stewart also mentions three degrees of attrition in Peruvian skulls, while Fischer, after an examination of the skulls of the prehistoric Indians of Wisconsin, notes that, in the majority of the 285 specimens examined, attrition of the third degree was evident when the specimens were in middle or advanced life. Thoma finds attrition of the teeth in great numbers as far back as 4800 B.C., and Pickerill, reporting on the conditions found in the teeth of the Maori, says that all skulls

showed marked attrition, even those of children from 12 to 14 years of age. This excessive wear of the teeth is mentioned also by Ritchie and Bagnall in connection with the eastern and western Eskimos.

In the present material, developmental hypoplasia of the enamel of the teeth, furthermore, was almost as common as attrition. To a greater or less degree, all of the teeth seemed to be affected, the anterior teeth perhaps more than the

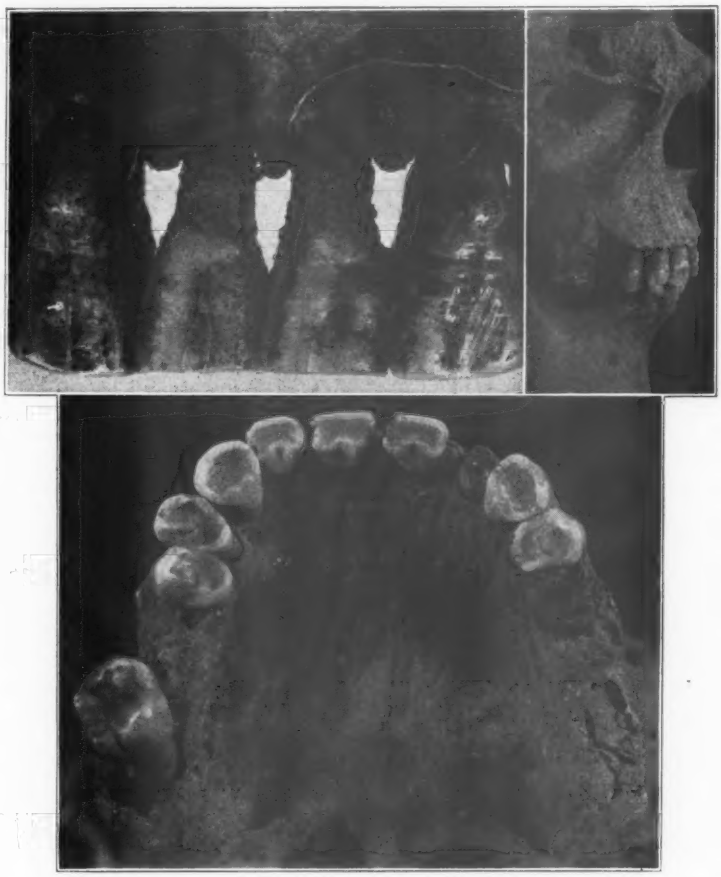

Fig. 3.—Above: Left: Alveoclasia, hypoplasia and deposits. Right: Attrition, pulp exposure in upper left lateral incisor, complete decay of upper left second bicuspid; nearly square palate associated with so-called pug nose. Below: Alveoclasia, with complete exfoliation of upper right second molar.

It would appear, therefore, that the diet of these ancient peoples may have been

molars. Leigh suggests that these defects probably result from nutritional disturbances during the developmental period. Bödecker, speaking of these defects in the teeth of ancient American Indians, says that they were as prevalent then as they are in the teeth today. The skulls here examined indicate hypoplasia more common then than now. This may account in part for the universal attrition noted. Campbell states that the Australian aborigine was strikingly free from developmental defects. Stewart finds a moderate degree of hypoplasia in Peruvian skulls, and Leigh notes that 5 per cent of the prehistoric inhabitants of Guam evidence developmental disturbance.

Alveoclasia, the destruction of the alveolar walls, was seen to a greater or less degree in twenty-one cases. One case was distinctly marked, ten were general, but considerably less marked, four were slight and three showed a wearing away of the lower anterior alveolar wall only. Alveoclasia around almost all of the teeth was found by Moodie in some prehistoric Indian skulls of California, and Leigh, in aboriginal California, finds alveoclasia occurring in 50 per cent of cases. Shaw too, in 132 skulls of Bantu races of South Africa which he examined, discovered alveoclasia in varying degrees in 50 per cent of cases, and Pickerill cites only one Maori skull in which the roots of the teeth were well nigh exposed by the excessive absorption of the alveolar process. Comparing the Hindu, the Australian aborigine and the Eskimo, Hellman finds that the Eskimo has the least extent of root exposure, and that the Hindu and Australian aborigine show a marked exposure of the root which would seem to be in excess of that found in these studies.

Pulp exposure occurred in forty-nine teeth from twenty-four skulls. Of this number, thirty-eight had developed abscesses, but in only half of these thirty-eight was a fistulous sinus present, less than might have been expected in view of the extreme attrition and caries which seem to have been responsible for producing these conditions. One case was probably caused by the suppurative process involved in the marked wearing away of the alveolar walls. Of the Egyptians, Sir Armand Ruffer says that alveolar and perialveolar abscess was common at all times and was evidently produced by the same processes as now, attrition and caries playing some part, but the majority being secondary to chronic suppurative periodontitis. Thoma also finds that the Chimu and Aymara tribes of the ancient Egyptians suffered much from abscesses of the jaws. Pickerill notes alveolar abscesses in the Maori skulls of New Zealand. Leigh finds in the Eskimo periapical abscesses occurring in 19 per cent of cases, and he finds in the people of prehistoric Guam periapical lesions in 16 per cent of cases. Campbell, speaking of the Australian aborigine, says that these lesions were almost entirely limited to old age. In the prehistoric Indian skulls from California which were examined by Moodie, abscesses with fistula were common.

Dental caries occurred in all but five skulls. The number of cavities in each skull ranged from one to fourteen. Both child skulls showed caries. A total of 197 cavities were noted, in order of prevalence as follows:

Occlusal cavities,	78
Disto-approximal cavities,	37
Mesial-approximal cavities,	27
Gingival cavities,	24
Completely decayed teeth,	19
Distoclusal cavities,	5
Buccal pit cavities,	3
Mesial occlusal cavities,	3
Mesial occlusal distal cavities,	1

Many of these cavities caused exposure

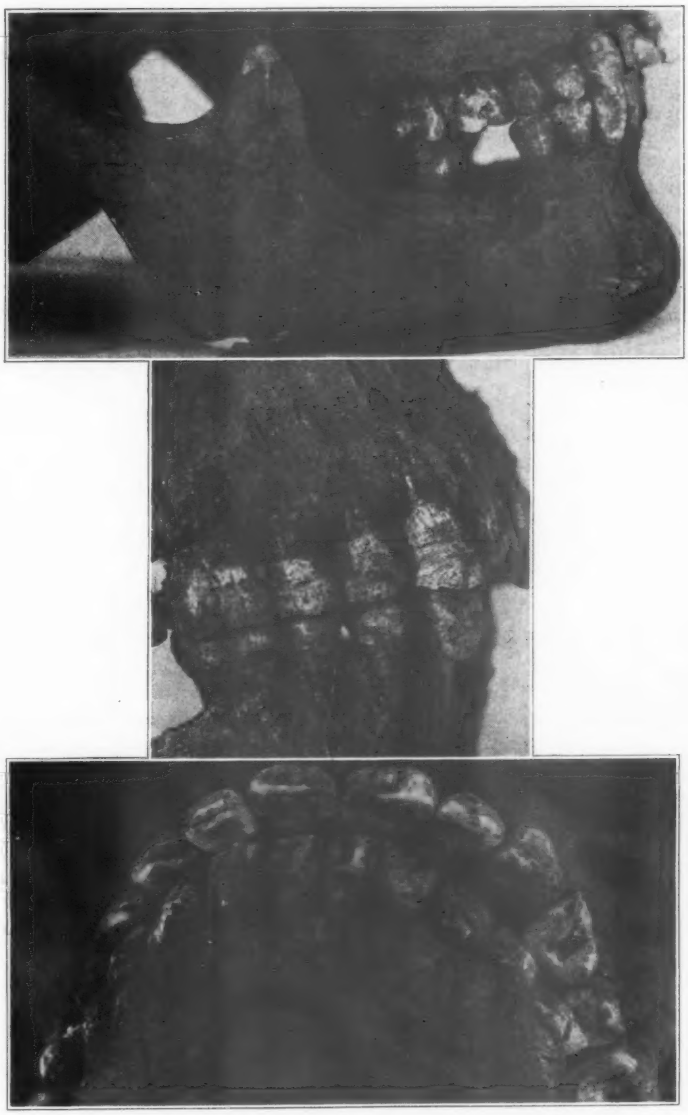

Fig. 4.—Above: Unusually low ramus, and bell-crowned molars, with hypoplasia. Center: Unusually long rooted upper teeth, with alveoclasia and hypoplasia. Below: Malocclusion, with rotation of upper left first bicuspid.

of the pulp and subsequent abscess formation. Here, the occlusal cavities predominated; whereas, Leigh finds that, in the aboriginal Californian, the proximocervical cavities predominated (more than 50 per cent). The predominance of occlusal cavities here may be accounted for in part by the fact that the developmental defects of the enamel may have permitted the products of putrefaction to attack the dentin more readily through the weak occlusal pits. In American children between the ages of 9 and 12, Butler finds 877 cavities in a total of 1,000. He states that this condition points to a faulty development of the enamel of some part of the masticatory surface. In a study of the prehistoric Indians of Wisconsin, Fischer found 24 per cent of dental caries, mostly of the occlusal surface, as found in the skulls studied here. Hooten found decay frequent in skulls from an Indian village site in Ohio. In aboriginal California, Leigh finds caries in 25 per cent and, in prehistoric skulls from Guam, he notes that 18 per cent of the skulls show dental caries. Shaw finds caries in 37 per cent of the Bantu races in South Africa. In comparing the amount of caries present, Hellman says that the Hindus have the highest percentage of caries, the Australians a lesser percentage, the American Indians a lower percentage than Hindus and Australians and the Eskimos the lowest percentage of all. Among the Eskimos, Leigh finds only about 1 per cent of dental caries, and Pickerill says that the Maoris were undoubtedly very nearly free from dental caries. McCurdy, reporting on "A Remarkable Human Lower Jaw from Peru," finds only one cavity in the sixteen teeth, and Moodie finds no caries in the prehistoric Indians of California. Thoma discovered little evidence of decay among the predynastic Egyptians. Sir Armand Ruffer says that dental caries occurred at all periods of Egyptian history and that it is impossible to say for certain without more extensive statistics whether caries was much less common in ancient than in modern times. Smith and Dawson also report dental caries back in predynastic and protodynastic times in Egypt. In a series of skulls of the fourth century A.D., caries was found in 86 per cent of cases; in a series from the eleventh to the thirteenth century, caries was found in 86 per cent of cases, and, in recent skulls, 90 per cent showed caries. From these facts, one might say that caries is more prevalent in modern than it was in ancient times, but one could hardly say that it is a disease of modern civilization.

Deposits of calculus about the teeth were found in nine skulls. These deposits ranged from light to heavy, and were equally divided between the lingual and buccal surfaces. The lower teeth were affected more often than the upper. Moodie, speaking of four skulls of prehistoric Indians of California which he examined, says that calculus was excessive on almost all of the teeth. In the skulls here studied, calculus was not excessive, nor was it as prevalent as seen in the people of today.

One skull presented an upper first bicuspid which was rotated one quarter turn in its socket, having its buccal surface pointing directly forward or toward the mesial. Two other cases occurred, one involving both upper first bicuspids, the other the second right upper bicuspid.

Six skulls presented bell-crowned teeth, representing a total of thirty-eight teeth, as follows:

Right upper first bicuspids,	2
Left upper first bicuspids,	2
Right lower second bicuspids,	2
Right upper second bicuspids,	2
Left upper first molar,	6
Right upper first molar,	6
Right lower first molar,	1

Left lower first molar,	1
Right upper second molar,	4
Left upper second molar,	4
Left upper third molar,	4
Right upper third molar,	4

Five skulls presented teeth with abnormally long roots. Of these teeth, three occurred in the maxilla and two in the mandible. In each case, the buccal and labial plates of bone were quite thin and the outline of the roots of the teeth could be seen plainly.

One skull showed both right and left upper third molars with three cusps, two buccal and one lingual. Aichel, in his detailed treatise on human teeth from a phylogenetic point of view, concludes that these upper molars with three cusps are primitive forms of teeth. Mendes Carrea says that the upper second and third molars of the Portuguese frequently have three cusps. Another skull presented an upper left third molar not unlike a normal bicuspid tooth. There are also two skulls wherein the lower first permanent molars have five cusps, two on the lingual and three on the buccal aspect. The upper first permanent molars of one of the same two skulls also have the same number of cusps. Sullivan says that, as a rule, the American Indians, Malays and Indonesians have five cusps on the lower molars. Shaw, on examining 196 Bantu skulls, found 108 lower second molars with five cusps, and of thirty-two Bushmen that he examined, he found eight with similar five-cusp molars. One other skull had six cusps, on the first permanent molar, three lingual and three buccal. This, according to Ritchie, frequently occurs in lower second molars of the western and central Eskimos. Speaking of the teeth of ancient Hawaiians, Chappel states that the number of cusps of the molar teeth show very little variation from those of the teeth of the Caucasians.

Two of the skulls showed exfoliation of some of the teeth due to the loss of their antagonists in the opposite jaw.

There were two cases of impacted third molars, both upper teeth in different skulls, one right and one left. Fischer says that impacted and supernumerary teeth were seldom found in the prehistoric Indians of Wisconsin. Thoma discovered that impacted teeth occurred in the predynastic Egyptian period.

SUMMARY

Attrition of varying degree was found in all of the forty-eight skulls here studied.

Developmental hypoplasia of the enamel of the teeth was almost as common.

Alveoclasia was noted in about 48 per cent of cases.

Pulp exposure occurred in about 50 per cent of cases.

Abscesses occurred in about 41.6 per cent of skulls.

With but five exceptions, caries was noted in all skulls. There was a predominance of occlusal cavities. The lower posterior teeth were affected more often by caries, after which, in order of degree of affection, came the upper posterior, the upper anterior and the lower anterior teeth.

Calculus appeared in about 18.7 per cent of cases and was more frequent in lower than in upper teeth.

In about 12.5 per cent of cases, bell-crowned teeth were seen.

Extra long-rooted teeth occurred in about 10.4 per cent of cases.

Rotated teeth, multicusped teeth, elongated teeth and impacted teeth were rare.

Malocclusion was also uncommon.

The incisors were shovel-shaped.

A PRELIMINARY REPORT ON THE USE OF AZOCHLORAMID AS A ROOT CANAL DISINFECTANT

By LOUIS I. GROSSMAN, D.D.S., Dr. med. dent. (Bostock), New York City

A DESCRIPTION of Azochloramid, a new bactericidal agent, has already appeared in THE JOURNAL.[1] This paper is a report on the use of Azochloramid as a root canal antiseptic in a group of forty cases. (The patients forming the basis of this report were treated at the School of Dentistry, University of Pennsylvania. Cultures were examined and reported on by the bacteriology department of the same institution.) This group does not represent a cross-section of root canal cases for which treatment is commonly undertaken in daily practice, but is composed of cases of more severe infection. Almost three fourths of the teeth treated had chronic abscesses, with definite areas of rarefaction. The remainder were cases of "granuloma," putrescent pulp or acute abscess. Wherever possible, pulpless teeth with areas of rarefaction were chosen because it was felt that if sterility, on the basis of cultures, could be obtained in these cases, less infected pulpless teeth would respond with even greater certainty. Also the influence of Azochloramid therapy on the involved periapical tissue could be determined later by means of a roentgen-ray check-up.

METHOD

Following is a synopsis of the course of treatment pursued:

Access was gained to the pulp chamber and all pulp débris was removed. If the tooth was tender to percussion or palpation, an antiseptic or sedative dressing was sealed in the pulp chamber at this time and allowed to remain until the following visit. When the tooth was comfortable, the canals were mechanically cleansed of débris. A control culture in hormone broth was then taken. Occasionally, sodium-potassium alloy was used to destroy pulp remnants. Only a minute amount, the size of a pinhead, was used at a time, generally only during the first visit and only in those canals wherein mechanical means alone were unsuccessful in removing pulp débris. The canal was then washed with sterile water and dried with sterile paper points. A dressing of Azochloramid in triacetin 1:100 was sealed in the canals, either with a double layer of guttapercha or with guttapercha covered with cement.[2]

Treatments were given twice weekly in one group of cases and once weekly in another group. (Table 5.) No significant difference in the treatment course of these two groups could be noted. At a subsequent visit, the paper point was removed from the canal. If it appeared clean or was still tinged with the yellow of Azochloramid, and if there was no excessive discharge from the canal or odor of putrescence, a smear was made. If the smear was negative, a culture was taken

1. Azochloramid, J.A.D.A., 22:666-668 (April) 1935; Ross, H. J.: Azochloramid in Root Canal Antisepsis, J.A.D.A., 22:637-646 (April) 1935.

2. Grossman, L. I.: D. Cosmos, 77:598-600 (June) 1935.

in hormone broth. When two successive negative cultures were obtained, the canal was filled. In all cases, the control culture, taken before treatment was begun with Azochloramid, was positive. At least two successive negative cultures were obtained in every case in which Azochloramid was used, so that no teeth in this group had to be sacrificed.

ANALYSIS OF DATA

While it is conceded that forty cases is a relatively small number from which to draw definite conclusions, the results may be considered suggestive.

An examination of Table 1 shows that the majority of patients treated in this group are under 30 years of age. Also, the greater number of teeth treated are anterior teeth. (Table 2.) To offset criticism, it must be stated that no selection was made with regard to age of patient or position of teeth in the dental arch, each patient being accepted for treatment as he presented himself, provided a definitely infected pulpless tooth was present. (Table 3 presents the clinical diagnoses.) Most of the cases in this group would ordinarily be considered bad risks for root canal therapy because of the degree of apical involvement present.

Two successive negative cultures were obtained after the fourth treatment with Azochloramid in about 75 per cent of the teeth treated. The maximum number of treatments given in any case before successive negative cultures were obtained was not more than seven. (Table 4.) A detailed summary of the teeth treated is given in Table 5. A striking characteristic observed frequently enough to merit special note is that fistulas closed relatively soon after treatment is begun, i.e., after a mean average of two and six-tenths treatments. (Column 7, Table 5.)

The possibility of occasional sterilization due to treatment with sodium-potassium alloy has been considered. In fourteen of the forty cases treated (Table 5, last column), this chemical compound was used after incomplete mechanical débridement. In only five cases, negative cultures were obtained after treatment; whereas, in the other nine cases so treated, positive cultures were still obtained, indicating no appreciable bactericidal activity of the alloy.

A roentgen-ray check-up on the apical condition of each tooth after treatment is in progress. While not enough time has elapsed since treatment of these teeth to take follow-up roentgenograms of all cases, when a check-up has already been made no retrogressive changes have been observed; in fact, a slight improvement is noted in some cases. (Figs. 1-2.)

Staining of the crown of the tooth

TABLE 1.—AGE GROUP

Age	Number of Cases
20 or under	22
30 or under	12
40 or under	4
50 or under	2

TABLE 2.—TEETH TREATED

Incisors and cuspids	29
Bicuspids	8
Molars	3

TABLE 3.—CLINICAL DIAGNOSIS

"Granuloma"	6
Chronic abscess	28
Acute abscess	2
Putrescent pulp	4

TABLE 4.—NEGATIVE CULTURE OBTAINED

	Number of Cases
After first treatment	2
After second treatment	6
After third treatment	10
After fourth treatment	14
After fifth treatment	4
After sixth treatment	2
After seventh treatment	2

TABLE 5.—EXPERIMENTAL DATA

Number	Patient	Age	Tooth Treated	Diagnosis	Concentration of Azochloramid in Triacetin	Irritation (Pericementitis) After Treatment Number	Fistula Closed After Treatment Number	Negative Culture After Treatment Number	Stain of Tooth from Azochloramid	Remarks	Preliminary Treatment with Azochloramid in Pulp Chamber Only	Sodium-Potassium Alloy Used During Treatment Number
1	E. A.	24	$\frac{\lfloor 5}{}$	Granuloma	1:250	–	–	4	–			1
2*	J. B.	32	$\frac{\lfloor 2}{}$	Granuloma	1:100	–	3	4	–			
3	E. B.	22	$\frac{1\rfloor}{}$	Acute abscess	1:100	–	3	4	–			1
4	C. B.	31	$\frac{\lfloor 5}{}$	Chronic abscess	1:100	–	–	3	–	Retreatment case		
5	N. B.	19	$\frac{\lfloor 1}{}$	Chronic abscess	1:100P†	–	–	2	Yes	Discoloration removed with sodium sulfoxylate		
6	N. B.	19	$\frac{1\rfloor}{}$	Chronic abscess	1:100P	–	–	2	Yes	Discoloration removed with sodium sulfoxylate		
7	N. B.	19	$\frac{\lfloor 2}{}$	Chronic abscess	1:100	–	–	5	–			1
8*	H. B.	14	$\frac{\lceil 6}{}$	Putrescent pulp	1:250	–	–	2	–		1	
9*	E. C.	22	$\frac{\lfloor 4}{}$	Chronic abscess	1:250	–	2	3	?	Uncertain; enamel thin; tooth removed for laboratory study	1	1
10	M. D.	16	$\frac{2\rfloor}{}$	Chronic abscess	1:100	–	–	5	–		1	
11	L. D.	24	$\frac{2\rfloor}{}$	Chronic abscess	1:100	3	–	4	–		1	1,3
12*	E. D.	26	$\frac{\lfloor 1}{}$	Chronic abscess	1:100	–	–	2	Yes	No attempt made to de-		

12*	E. D.	26	$\frac{1}{1}$	Chronic abscess	1:100	–	–	2	Yes	No attempt made to decolorize		
13	S. G.	26	$\frac{5}{}$	Putrescent pulp	1:250	–	–	4	–			
14	J. H.	16	$\frac{1}{}$	Chronic abscess	1:100	–	3	5	–			1,2,3
15	J. H.	16	$\frac{}{1}$	Chronic abscess	1:100	2,3	–	4	–			1,2,3
16	J. K.	17	$\frac{1}{}$	Chronic abscess	1:100	–	–	3	Yes	No attempt made to decolorize	1	1
17	J. K.	17	$\frac{2}{}$	Chronic abscess	1:100	–	4	7	–	First negative culture after fifth treatment but sixth treatment positive		1
18	S. K.	36	$\frac{1}{}$	Granuloma	1:100	–	1	2	–			
19	E. K.	27	$\frac{4}{}$	Chronic abscess	1:100	2	–	3	–		1	
20*	P. L.	20	$\frac{4}{}$	Chronic abscess	1:250	–	–	3	–	Retreatment case		
21	F. McH.	25	$\frac{5}{}$	Chronic abscess	1:250	–	–	3	–	Retreatment case		1
22	C. McL.	48	$\frac{3}{}$	Chronic abscess	1:100	–	–	7	Yes	First negative culture after fifth treatment but sixth treatment positive; decoloration with Pyrozone failed		
23*	J. M.	20	$\frac{2}{}$	Chronic abscess	1:100	–	–	4	–			
24	S. M.	14	$\frac{}{1}$	Chronic abscess	1:100P	–	–	4	Yes	First two treatments without Azochloramid powder; no attempt made to decolorize		

(Continued on next page)

TABLE 5.—EXPERIMENTAL DATA (Continued)

Number	Patient	Age	Tooth Treated	Diagnosis	Concentration of Azochloramid in Triacetin	Irritation (Pericementitis) After Treatment Number	Fistula Closed After Treatment Number	Negative Culture After Treatment Number	Stain of Tooth from Azochloramid	Remarks	Preliminary Treatment with Azochloramid in Pulp Chamber Only	Sodium-Potassium Alloy Used During Treatment Number
25	S. M.	14	$\underline{\lfloor 1}$	Chronic abscess	1:100P	–	–	2	Yes	No attempt made to decolorize	2	
26	S. M.	14	$\underline{2\rfloor}$	Chronic abscess	1:100 1:100P	1	–	4	–	First two treatments with Azochloramid 1:100 and next two with Azochloramid powder 1:100		
27	S. M.	14	$\underline{\lfloor 2}$	Chronic abscess	1:100P	–	–	3	Yes	No attempt made to decolorize		
28	K. M.	14	$\underline{\lfloor 1}$	Chronic abscess	1:250	–	–	4	–			1
29	B. M.	15	$\underline{\lfloor 2}$	Granuloma	1:250	1	–	4	–			1,2
30	W. N.	29	$\underline{\lfloor 1}$	Chronic abscess	1:100	–	–	6	Yes	Decolorized with sodium sulfoxylate		
31	F. O'H.	13	$\underline{\lfloor 1}$	Chronic abscess	1:100	–	–	1	–			
32	A. P.	15	$\underline{2\rfloor}$	Chronic abscess	1:100	–	–	1	–			
33*	I. R.	24	$\underline{\lfloor 1}$	Putrescent pulp	1:100	–	3	4	–			1
34	O. S.	16	$\underline{2\rfloor}$	Acute abscess	1:250	–	2	4	–			1

35	K. S.	24	$\frac{2}{}$	Granuloma	1:100	–	4	5	–			
36*	R. S.	13	$\frac{6}{}$	Putrescent pulp	1:250	–	–	3	–			
37*	V. S.	32	$\frac{1}{}$	Granuloma	1:100	–	–	6	Yes	Decolorized with sodium sulfoxylate		
38	I. S.	16	$\frac{6}{}$	Chronic abscess	1:100	–	–	3	–			
39	E.M.W.	25	$\frac{4}{}$	Chronic abscess	1:100	–	–	4	–			
40	J. W.	42	$\frac{3}{}$	Chronic abscess	1:100	4	2	3	–			

*Weekly treatments; all others twice weekly.
In addition to 1 per cent Azochloramid solution, the paper point was dipped in Azochoramid powder and the adherent crystals were carried into the root canal.

occurred occasionally. The cause of this stain is not definitely known, since in adjacent teeth in the same mouth, one tooth became stained, while the other was unaffected. It is practically certain that a new compound must be formed with Azochloramid to cause this discoloration. The staining, which varies from light yellow to light brown, can be prevented by coating the cavity of the tooth with a cavity varnish before treatment with Azochloramid. The dentin should first be thoroughly dried with alcohol or chloroform. A thin coat of the varnish is then applied. A second application is made after the first has thoroughly dried. If this precaution is not taken and staining should occur, the stain may be bleached out after the root canal is filled, by placing in the pulp chamber a pledget of cotton soaked with a saturated aqueous solution of sodium sulfoxylate. The dressing should preferably be sealed in with oxyphosphate of zinc cement, the cotton being as well saturated with the drug as possible, but the margins of the cavity should be dried thoroughly before the cement is applied. In this way, the solution of sodium sulfoxylate will be sealed in the tooth and will ultimately diffuse into the tubuli to reach the stain. Another application of sodium sulfoxylate should be made about a week later. Complete decoloration of the stain did not occur in every case, but when decoloration was imperfect, the residual stain was inconspicuous.

The staining in ten cases of this series can probably be accounted for by the fact that, in almost every instance, the cavity was so large that it left a thin dentino-enamel wall through which Azochloramid was readily diffused. Also, some of the teeth treated had long standing caries and exposure of the root canals to the action of saliva, both of which would have a tendency to extract the in-

organic salts from the dentin and render the tooth permeable. In another series of cases, reported elsewhere,[3] the incidence of staining from Azochloramid was much lower.

In addition to the clinical data reported here, laboratory tests were conducted to study the effect of Azochloramid on apical tissue. The pulps of all four third incisors of a dog were removed and the canals were dried with sterile paper points. The third incisor teeth were arbitrarily labeled in a clockwise direction from 1 (lower left third incisor), to 4. Dressings of Azochloramid 1:250 were sealed in 1, camphorated monochlorphenol in 2 and Azochloramid 1:100 in 3, no medication being used in 4, which was regarded as a normal control tooth. Dressings were changed in each of these teeth on the following dates: Sept. 19, 24 and 28 and Oct. 2, 1934. The dog was killed October 4 and the jaws were given for histologic study of the apical tissues to H. R. Churchill, who was not informed as to what treatment the teeth had been subjected to. His report follows: "None of the specimens showed inflammatory reactions. All specimens presented a normal bone marrow adjacent to the fundus alveolaris. The dentoperiosteal fiber groups were intact. No destructive processes were encountered anywhere. In specimen 2, there is some evidence of osteogenesis in the apical region. Summarizing, I may say that no pathologic conditions were found in any of the specimens."

Fig. 1. (Case 29, Table 5).—Above: Appearance of root canal immediately after treatment with Azochloramid and filling, Aug. 24, 1934. Below: Check-up film taken Jan. 31, 1935.

Fig. 2. (Case 2, Table 5).—Above: Appearance of root canal immediately after treatment with Azochloramid and filling, Dec. 29, 1934. Below: Check-up film taken May 17, 1935.

3. Grossman, L. I.: Root Canal Therapy with Azochloramid, D. Cosmos, 77:598-600 (June) 1935.

SUMMARY

1. Forty pulpless teeth, 85 per cent of which had definite areas of rarefaction, were treated with Azochloramid.

2. In 80 per cent of the teeth treated, two successive negative cultures were obtained after four treatments, or less. In the remaining 20 per cent, negative cultures were obtained after from five to seven treatments.

3. Fistulas when present generally closed after the second or third treatment without other therapy.

4. While staining occurred in some cases, means are available for preventing the stain as well as decolorizing it.

5. A roentgen-ray check-up is in progress. In the few cases wherein a check-up has already been made, the apical condition either shows no retrogressive changes or is suggestive of improvement.

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ULCERATIVE STOMATITIS FOLLOWING THE THERAPEUTIC USE OF MERCURY AND BISMUTH*

By LAWRENCE H. AKERS, D.D.S., Hot Springs National Park, Ark.

ULCERATIVE stomatitis is an acute inflammation of the soft tissue of the mouth, often involving the alveolar process, with a resultant necrotic degeneration of these tissues, caused by the therapeutic use of either mercury or bismuth. Though universally recognized, it is apparently little understood by either the medical or the dental profession. Contrary to popular opinion, mercurial poisoning is not always accompanied by salivation, which is merely an excessive flow of saliva and is not responsible for, nor does it suggest, the necrosis seen in this form of stomatitis. To say that a patient with stomatitis is salivated is to describe a complication and not the disease itself.

An extended experience in a large hospital, the vast majority of whose patients are receiving antisyphilitic treatment, has afforded me an opportunity to make a thorough study of the etiology and pathology of this complication. These observations are not recorded statistically, but an attempt has been made to discuss the process as a whole, and finally to suggest the relationship of the observed facts to the treatment and prevention of these conditions.

CLINICAL PATHOLOGY

In the beginning, the palatal tissue immediately posterior to the upper central incisor teeth is usually marked by a mild soreness, extreme redness and some swelling. This involves the entire mucous membrane of gum and palate in from one to seven days, this depending on the amount of metal given, the general condition of the mouth and the individual tendency toward metallic poisoning. The bright redness of the gum soon changes to a bluish, cyanotic color as inflammation increases. The saliva is thick, stringy

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-Seventh Annual Session of the American Dental Association, New Orleans, La., Nov. 6, 1935.

and markedly acid. Usually, within a week, a marked accumulation of pus, decaying food, dead tissue and bacteria is found around the necks of the teeth. This precipitate, which is greenish and distinctly fetid, always appears immediately before and during necrosis, and increases in amount with the necrotic process. As tissue degeneration continues, the gums slough away, the crest of the alveolar process is slowly destroyed and yellowish gray ulcers appear on the cheek, palate, tongue, floor of the mouth and gums. The teeth become loose and the whole oral cavity, in severe cases, is covered with a stringy, putrescent mass of rotting flesh. The lymph glands of the neck are, of course, greatly swollen and hard, even to such an extent as in carcinoma. Septicemia or any of the general conditions following development of a focus of infection may appear. In later stages, scar formation from cheeks to gums is seen, being due to connective tissue proliferation in the ulcerated tissue, and true bony ankylosis of the temporomandibular joint may follow. Osteitis of either mandible or maxillae is not infrequent, and development of Ludwig's angina or noma is possible.

ETIOLOGY

Mercury and bismuth, as far as their etiologic relation to stomatitis is concerned, have the same reaction. They are eliminated from the body in the same manner: through the bowels, kidneys, salivary and sweat glands and the capillaries of the mucous membrane. We are, of course, concerned only with the salivary and capillary elimination. The mercury or bismuth in the blood that is deposited in the salivary glands is discharged into the mouth with the saliva; and that deposited in the capillary endothelial cells is eliminated in the serous exudate of the mucous membrane of the oral cavity. The union of the sulfides produced by the putrefaction of the tissues, that is, hydrogen sulfide, protein sulfides, etc., and the mercury or bismuth discharged into the mouth fluids, forms sulfides of these metals. It is the irritation of these metallic salts, together with the presence of a nidus of infection on the necks of unclean teeth, in a bacteria-infested mouth, that results in inflammation and necrosis. The principal difference in the appearance of stomatitis caused by ingestion of bismuth and that caused by ingestion of mercury is in the formation of the characteristic "blue line of bismuth." The presence of many mouth bacteria, they being acid producers, so increases the normal acid content of the mouth fluids that electrolysis takes place between the salts of mercury or bismuth and the various metals used in dental restorations, with the resultant precipitation of the mercury or the bismuth. This process goes so far as to involve precipitation of metallic salts even in the capillaries of the mucous membrane.

Mercury, which is lower in the electromotive series than bismuth, does not so easily enter into an electrochemical reaction as the latter metal, the salts of mercury being remarkable for the fact that, as compared to other salts, they are ionized very little in solution; and therefore black bismuth sulfides are more liable to formation within the capillary walls themselves than are the sulfides of mercury. Herein lies the reason for the so-called "blue line of bismuth" and the reason that no such line occurs with mercury. Mercury salts, usually light in color or colorless, are precipitated to a slight degree by electrolysis; while bismuth, more prone to chemical reaction, is precipitated over the depth of the entire mucous membrane surface of the mouth, but particularly concentrated in a thin line on the crest of the gum tissue. This

concentrated bismuth is granular, and grayish black; hence, the blue line. If no fillings or other metallic appliances are present in the mouth, electrolysis does not take place; therefore, no blue line is formed.

Ulcerative stomatitis may result from direct contact and absorption of either mercury or bismuth in its pure state or in chemical combination. The chemical state, be the drug pure, a salicylate or a chloride or what not, has no bearing on the degree of oral inflammation. This is due rather to the method of administration and the amount of metal given. Mercury inunctions produce the quickest and most disastrous results, owing to slow but constant absorption of the mercury. Intramuscular injections produce the same condition, though less frequently. Ingestion of mercurous chloride (calomel) produces its share of stomatitis, but without such disastrous results; for, of course, the mercury dosage is much less than that given by other methods. As little as 2 grains of mercurous chloride has been known to produce death from stomatitis, but such cases are probably due to idiosyncrasy. The truly serious conditions that I have seen following administration of mercurous chloride have occurred in children under 6 years of age. Mercurochrome intravenously injected is the least toxic of all. I have seen but few cases of stomatitis following its use. Intramuscular and intravenous injection of bismuth is a comparatively recent procedure and the relative toxicity of its various salts is not so well known. The period of onset, that is, the stage of extreme redness of gingival and palatal tissue, is greatly prolonged. The several hundred cases of bismuth stomatitis that we have seen were much more resistant to treatment, but less severe in action than those due to the use of mercury.

PREVENTION AND TREATMENT

Prevention and treatment should be planned so that patients may be spared the pain of an inflamed mouth, the damage to, or loss of, valuable teeth and the dangerous complications following development of a focus of infection; in order that our medical colleagues may, with safety, continue antisyphilitic treatment with the best results and in the shortest possible time. Such measures of prevention or treatment of mercurial and bismuth stomatitis are basically dependent on one all important condition, cleanliness. Given a clean, healthy, deposit-free mouth to begin with, and the care to keep that mouth in good condition during treatment, and no amount of mercury or bismuth will cause an oral inflammation.

As regards the mouth in cases already under antisyphilitic treatment and that is in an inflamed or necrotic condition, complete oral prophylaxis is a necessity, including not merely scaling and polishing but also the removal of unsanitary bridgework, crowns or fillings, the extraction of pulpless teeth as well as those badly infected with pyorrhea, and at least the removal of decay and temporary filling of the large cavities present in those teeth to be retained. The most severely inflamed area is invariably around unsanitary bridges and crowns. They provide a bacterial nidus par excellence and the inflammation will not yield to treatment as long as they are retained in the mouth. One need not hesitate to extract in these cases regardless of the amount of infection present. Conductive anesthesia should not be used when infiltration or general anesthesia is practicable. None at all should be used in that large number of cases in which the teeth are loose and easily removed. Do not deduce from this that I entertain any fears about infiltrating an anesthetic into necrotic

gums; nor have I had a single untoward result following such injection in many thousand extractions in these cases. I look with disfavor on the mandibular and infra-orbital injections when advanced necrosis is present, as carrying a possible infection too deeply into healthy tissue. It is true that postoperative healing is slow, but no more so than in any case of syphilis.

Aside from the preparation of the mouth as described above, treatment of these cases is simple. Daily, or at least biweekly, as the case demands, deep pockets and ulcerated surfaces are thoroughly cleansed with equal parts of tincture of aconite and iodine, then irrigated with a saturated solution of sodium bicarbonate. The combination of aconite and iodine has given the best results of all drugs that we have used owing to the fact that it precipitates bismuth or mercury as an insoluble iodide. Sodium bicarbonate acts as a neutralizing agent on the bacterial acid present in the mouth, and possibly limits the union of mercury or bismuth with bacteria-produced sulfides, as well as destroying, or preventing the establishment of, an electrolytic field. Irrigation is carried out preferably with the compressed air syringe of enough pressure to remove much of the precipitate and gangrenous tissue. It is important that this gangrenous tissue be removed even to a raw and bleeding but healthier surface. I have done this with a glove inclosed finger and even with a stiff bristle toothbrush. Thus, we remove the stomatitis precipitate and, at the same time, apply a rubefacient antiseptic to denuded tissue surfaces.

Our patients are all given typed instructions for home care of the mouth to be used in conjunction with office treatments and as long as they are taking mercury or bismuth. These instructions, purposely made simple and easily understood, are as follows:

1. Sodium bicarbonate (baking soda).
   - A. Teaspoonful in palm of left hand.
   - B. Wet thumb and first finger of right hand and dip in soda.
   - C. Rub gums.
     1. With soda dipped thumb and finger, from above down on the upper, and from below upward on the lower.
     2. Do not spit soda out during this procedure or for at least three minutes thereafter.
   - D. Rinse the mouth with a glass of hot water.
   - E. Repeat as often as directed. (Three times a day to hourly)
2. Brush your teeth with soda only, on a soft toothbrush twice a day, morning and night.

Further explanation of these instructions is unnecessary. The value of sodium bicarbonate in these mouths has been explained. Massaging of the gums by the patient with the finger, of course, promotes circulation of the blood and therefore improves the health of the tissue. To say that globules of mercury are pressed from the gum capillaries seems to me quite far-fetched. Massage is without doubt very good in a deposit-free mouth, but given a mouth of broken roots, ill fitting crowns and fillings, and rough calculus, and irritation is increased rather than reduced.

May I add a word here regarding the use of salt in ulcerative stomatitis? A number of patients seem to have acquired a salt complex, considering it a panacea for all mouth ills. Sodium chloride does definitely increase the inflammation in these cases, owing to its caustic effect, and so should never be used. As for proprietary mouth washes, none of them that I have used answers our purpose and some are far more harmful than otherwise.

Diet, to my mind, has little or no

bearing on this condition. The presence of strongly acid fruit juices on a bleeding, raw surface may produce some local pain, but does not otherwise increase inflammation and certainly does not aid the progress of necrosis. Of course, systemic hyperacidity retards the recuperative powers in any pathologic condition. Saline cathartics will usually promote elimination and, at the same time, supply sufficient alkalinity to the body.

It is regrettable that, because the physician has so little regard for the dentist's ability to cope with this condition, mercury and bismuth are routinely given without the patient's first consulting the dentist, and when the mouth becomes highly inflamed, the patient is merely told to "lay off treatment until the inflammation subsides." There are three results: The dentist is totally ignored or at least given a difficult case to handle; the patient's mouth is irreparably damaged and his specific treatment is interrupted, and the physician is forced to retard or prolong his period of service at the expense of the final result of his treatments. Such a condition is obviously due to a lack of confidence in the dentist, on the part of the physician, inspired by failure on the part of both to understand the cause, effect and treatment of these cases. This is offered not so much in a spirit of criticism of the ability of the physician or dentist, but rather to call attention to the lack of cooperation between the two.

CONCLUSION

May we as dentists look on these cases as offering an ideal opportunity for cooperation with the physician, to the end that his confidence in us, as a profession, may be more firmly established. We must remember, and firmly impress on patient and physician, that a clean mouth, in which reasonable measures are taken to maintain health, is not subject to ulcerative stomatitis, regardless of the amount of mercury or bismuth given the patient.

NEW DATA ON THE CHEMOTHERAPY OF INCIPIENT CARIES*

By JAMES MARK PRIME, D.D.Sc., F.A.C.D., Omaha, Nebr.

SEVERAL years ago, Dr. Leigh expressed the opinion that a chemical would be discovered which, if applied on the teeth, would prevent the surfaces from decaying. I am presenting evidence that such a chemical has been found.

It has been increasingly evident to me that our efforts to prevent the loss of teeth from caries have had the wrong approach. We have failed to prevent the onslaught of caries by permitting cavities to develop to the point where the holes must be stopped with a foreign body. We have tried to give some dignity to this hole-filling process by calling it a restoration.

We have become an organization of prospectors with picks and shovels searching for "holes." We ought to know the "hole" is not the beginning, but is the

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-Seventh Annual Session of the American Dental Association, New Orleans, Nov. 7, 1935.

result of a process going on for months or perhaps years. We have been unable to detect these lesions until a hole is present and detectable with our pick. From that point, we seem to get our bearings and proceed, in some instances, along what might be called comprehensive lines.

We occasionally flaunt our results in these hole-filling processes, overlooking the fact that each filling is a monument to our ignorance. Each filling is exhibit No. 1 in evidence that we have failed at prevention. Prevention that prevents prevents the cavity. It is not reasonable that we can prevent a cavity when we blind ourselves to the conditions leading up to the cavity. While our knowledge of caries etiology is limited, we do have knowledge of what is taking place locally leading up to the cavity.

It is at this stage that we may enter the picture and prevent the cavity. Each smooth surface cavity is preceded by an acid-etching process. This process, as stated, may continue for months and in many cases for years. In its early stages, it is macroscopically invisible. At this stage, it is a surface involvement only. No mechanical filling is indicated because, as yet, there is no "hole" to fill.

Not until I began this study did I realize the enormous numbers of cases of this invisible etching slowly working its way through the hard enamel plate. While it is more prevalent in growing children, I have found it in all ages.

These organisms seem to experience much difficulty in attaching and holding their colony in the initial attack. Until they succeed in forming their gelatinoid covering, they are susceptible to the slightest disturbance. At this stage, they may be washed away by moving fluids and a slight mechanical or chemical disturbance may completely break down their attachment. After they are allowed to remain undisturbed for a time, they produce a slight roughness, which makes them increasingly secure against dislodgment. Simultaneously, organisms may reach the more easily dissolved dentin, after which large numbers of cavities rapidly develop. This may explain what we have thought of as sudden attacks of susceptibility, or a so-called sudden breaking down of immunity. The truth is, these smoldering fires, lacking fuel by consuming which they could flare up, have been steadily progressing unobserved. This process could be illustrated by a line beginning at zero and running straight for a long time, and very slowly rising, first so little that the rise is imperceptible until, at the etching stage, it shows a perceptible bend, and when the organisms make for themselves a mechanical shelter, the curve gently rises until the dentin is reached, at which time, a condition similar to that seen in a test tube is created, and the curve rises rapidly toward the perpendicular.

It is in this acid-etching precavity stage that the chemical referred to is valuable. This etched surface is a multiplicity of interstitial spaces created by the solution of the mineral salts by the acidogenic organisms. In these spaces are deposited innumerable little metal-like fillings precipitated from this chemical.

The etched lesion, which was wholly invisible, is now definitely disclosed. This disclosure would be of minor value were it not for the coincidental development of a high caries resistance.

Years ago, I began using this solution for the sole purpose of disclosing the invisible etchings that I might fill them early. After applying it on hundreds of proximal surfaces, I discovered that I did not have to fill them, for no cavities developed. Another surprise awaited me in that proximal etchings are well-nigh universal. Up to the present time, I have

found but one person free from them. Exception, of course, is made of those people whose teeth are not in proximal contact, also lower anterior teeth, the immunity of which runs very high.

This immunization is especially indicated in the upper six anterior teeth, for the reason that the incidence of proximal caries is very high; that the loss of these teeth involves such disfigurement, and that we have no satisfactory filling materials for these teeth.

I am surprised, as you would be, to find that those surfaces, free from etching and with no stains showing, and on which I have applied the solution, have, up to the present time, continued immune. This I have observed in mouths in which active caries developed in untreated proximal surfaces.

I have treated 405 proximal surfaces of upper incisors and cuspids. To the most susceptible, I have applied the chemical as often as four times a year. Some I have treated twice yearly and a few only once. A few of these I have treated only recently. Some of them are going into the fifth year. The patients are mostly children from 10 to 16 years, the period when caries is most active.

Without exception, caries has stopped on all surfaces where an actual cavity had not developed. I filled most of the cavities where the enamel had been penetrated. When the shadow from the penetration showed on the lingual and not on the labial aspect, I have, with few exceptions, left the teeth alone and they seem not to decay.

In all these cases, I have advised no change in mouth hygiene, either brushing or use of floss. Neither have I advised any change in food habits, the intention being to put the treatment on its merits alone.

I have treated 282 proximal surfaces of bicuspids and molars. Because these surfaces are wider, it is impossible to quote such accurate results of the treatment as I gave on the front teeth. Many of the bicuspids seem to be thoroughly immunized.

The most positive results are obtained in the case of the front upper teeth, and it is there that it is most needed. We have fillings for the back teeth that serve us very well, but no satisfactory filling for the upper front. Then too, the chemical is most easily applied on these front teeth and results are most easily observed.

I recently had a patient 86 years old who had proximal decay on the lower incisors and cuspids, which, she said, came in one year. Caries had no doubt been developing for years. Such cases as these would indicate that at no time are we free from the danger of proximal caries.

Since the days of John Hunter, the profession has been waging a losing fight against dental caries. People have almost worn the teeth off and greatly injured the gingival tissues by injudicious brushing. Still teeth decay. More dentists, more toothbrushes, more decay and more lost teeth.

Numbers innumerable of large fillings and crowns and loss of a host of teeth started with an invisible etching which, had it been treated with this solution while it was on the surface, would have been prevented.

Evidence seems to be accumulating that systemic conditions not well understood as yet are playing a rôle in caries etiology. Until this rôle is clarified, it will be well to direct our attention to local control.

This solution referred to is known as Howe's ammoniacal silver nitrate. My experience warrants the conclusion, that, if it is applied at the right time and in the proper manner, surface-etching caries will cease.

The technic of application is fully described elsewhere.[1]

I am reporting my own experience in the use of this solution over a period of years and have here given a report on 405 carefully observed cases that have been recently rechecked. It is of the utmost importance that we accumulate at the earliest possible time evidence of the effectiveness of this method, and in such form that it cannot be questioned. By this, I mean that a plan should be set up by which thousands of cases will be very carefully recorded and tabulated under the direction of experienced research workers, in order that the weight of evidence will be such that every practitioner will be compelled to accept it.

1. Prime, J. M.: D. Cosmos, 77:1046 (Nov.) 1935.

PHARMACOLOGIC AND CLINICAL STUDY OF B-BENZOYLOXY-B-PHENYL-ETHYL-DIMETHYLAMINE-HYDROCHLORIDE: A NEW LOCAL ANESTHETIC*

By ERWIN WILLIAM FERBER, D.D.S., M.S., San Francisco, Calif.

IN an effort to prepare local anesthetic compounds that exhibit both local anesthetic and vasoconstrictor activity, several investigators[1] have prepared and studied derivatives of arylaminoalcohols related in chemical constitution and physiologic action to epinephrine. Such compounds are desirable particularly from two points of view: (1) theoretically, to advance knowledge of the possible relationships between constitution and physiologic action and (2) practically, to offer a compound that does not require the use of epinephrine to secure desirable local effects and thus to avoid untoward systemic reactions resulting from such addition to local anesthetic solutions. A generation ago, Braun[2] proposed the addition of epinephrine as a satisfactory adjunct in local anesthetic solutions to produce local vasoconstriction, thereby reducing the rate of absorption of the local anesthetic, prolonging the latter's effect and diminishing its systemic absorption and the attendant toxicity. It has been shown also[3] that the epinephrine so added may produce undesirable side effects and actually cause an increased toxicity due to the

*Read before the Research Section of the California State Dental Association, April, 1935.

1. Takeda, J.: Rearrangement of 2-Benzamido-1-Phenylethanal into Amino-Aphenylethyl Benzoate, J. Pharm. Soc. Japan, 1917, pp. 691-709; Chem. Abs., 11:3241, 1917. Marvel, C. S., and Du Vigneaud, V.: Pressor Anesthetics, J. Am. Chem. Soc., 66:2093, 1924. Alles, G. A., and Knoefel, P. K.: Local Anesthetics with Vasopressor Activity, Arch. internat. de pharmacodyn. et de thérap., 47: 96 (Jan.) 1934.

2. Braun, Heinrich: (Trans. and ed. by Harris, M. L.): Effect of Suprarenin (Adrenalin) on Local and General Poisoning, in Local Anesthesia, Philadelphia: Lea and Febiger, 1924, p. 32.

3. Spagnol, G.: Pharmacology of Solutions of Novocaine-Vasopressin and Novocaine-Adrenaline in Local Anesthesia, Rev. Sud-Americana Endocrinal Immunol., 14:569, 1931; Chem. Abs., 26:773, 1932.

presence of the local anesthetic, which is absorbed systemically.

The benzoate of phenylethanoldimethylamine, or more exactly *B*-benzoyloxy-*B*-phenyl-ethyl-dimethylamine hydrochloride, called for convenience "locaine," is a compound of the type described. The similarities in combined structure and properties of procaine, a local anesthetic; epinephrine, a vasoconstrictor, and the new local anesthetic "locaine" are illustrated in Figure 1.

An earlier study of the pharmacologic properties[4] indicated that it possesses both anesthetic and vasoconstrictor activity of an interesting degree. It seemed worth while, therefore, to determine whether this new drug could be applied clinically for various operations in the field of oral surgery. The results have been, in some respects, highly satisfactory, but, in others, it proved to be inferior to procaine.

This substance was selected by G. A. Alles and P. K. Knoefel from a considerable group of compounds, used for their comparative pharmacologic studies of esters of arylethanolamines, as being the most suitable of those investigated. The compound was synthesized by Dr. Alles and its pharmacologic activities were investigated by Drs. Alles and Knoefel.

A comparison was made of the anesthetic activity of "locaine," cocaine and procaine on the cornea of the rabbit and on the sensory fibers of the frog's sciatic nerve. Data for their relative intravenous toxicity in rabbits and subcutaneous toxicity in mice were obtained also. These data as reported[4] are as given in Table 1.

It appears that "locaine" is almost as effective as cocaine in its anesthetic action on mucous membranes, where procaine is quite ineffective. On the frog's sciatic nerve, "locaine" was found to be much less toxic than cocaine, and about as toxic as procaine by subcutaneous injection, though more toxic than procaine by the intravenous method of administration.

These laboratory findings indicate that "locaine" may have real clinical possibilities as a useful anesthetic agent, particularly in dentistry.

Certain further preliminary laboratory work was carried out before the drug was studied clinically with regard to its local anesthetic activity in the oral cavity and to determine more precisely its toxicity by various routes of administration.

TABLE 1.—DATA ON RELATED AGENTS

	Anesthesia: Rabbit Cornea Duration in Minutes		Toxicity: Minimum Lethal Dose Millimols per Kilogram	
	0.04M	0.02M	Intravenous	Subcutaneous
B-hydroxy-*B*-phenylethylamine	0.1M	No Anesthesia	0.17	5.0
B-benzoyloxy-*B*-phenylethylamine	26	18	0.10	0.4
B-hydroxy-*B*-phenylethyl dimethylamine	0.1M	No Anesthesia	0.80	5.0
B-benzoyloxy-*B*-phenylethyl dimethylamine	17	12	0.07	2.7
Cocaine	20	16	0.04	0.45
Procaine	—	—	0.13	3.0

4. Footnote 1, third reference.

This work on "locaine" included a study of: (1) some chemical properties of its solutions; (2) infiltration and block anesthesia in the oral cavity of the dog; (3) toxicity by subcutaneous injection, and (4) toxicity by intravenous injection, with studies on: (*a*) the phenomena of acute intoxication, (*b*) toxicity from rapid intravenous injections, (*c*) toxicity from slow intravenous injections and (*d*) fixation, elimination or destruction by the liver.

Part of the preliminary work was done by Alles and Knoefel, who compared the relative toxicities of "locaine" injections in rabbits and mice. Comparisons were also made of mucous membrane anesthesia, by observing the corneal reflexes.[4] From Figure 1, it is evident that "locaine" is much less toxic than cocaine and that its anesthetic action on mucous membranes is almost as satisfactory.

Table 2.—Data Indicating Acidity of Locaine

	p_H
1.0 gm. of "locaine" added to 99.0 c.c. of cold distilled water	4.7
1.0 gm. of "locaine" added to 99.0 c.c. of normal saline solution	4.6
1.0 gm. of "locaine" added to 99.0 c.c. of boiling distilled water and boiled for ten seconds after the addition of "locaine"	4.4
1.0 gm. of "locaine" added to 99.0 c.c. of boiling distilled water and boiled for twenty minutes after the addition of "locaine"	3.7

These laboratory findings, convincing as they are, omit any reference to clinical experiments and it therefore seemed desirable to determine the clinical possibilities of "locaine," especially for dentistry.

The work undertaken included a study of "locaine" in comparison with such well-known agents as cocaine and procaine, using suitable experimental animals, as to (1) its relative toxicity, (2) its relative efficiency as a local anesthetic and (3) its relative efficiency as a topical anesthetic.

Physical and Chemical Properties of "Locaine"

"Locaine" possesses the empiric formula $C_{17}H_{19}O_2N$-H Cl, and a molecular weight of 305.6. Its structural formula is given in Figure 1. It is a white crystalline substance, soluble in water to the extent of 4.236 gm. in 100 c.c. solution of distilled water at 20 C. It melts at 211-212 C.

"Locaine" is capable of acting on nerve tissue in a circumscribed area, either by topical application or by injection into the tissues. It produces a paralysis which temporarily inhibits the conductivity without causing permanent tissue injury. An aqueous solution of "locaine" is definitely acid. Table 2 illustrates this fact.

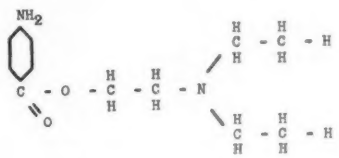
It is well known that irritability and toxicity of anesthetic solutions increase in direct relation to lowering of the p_H, and also, up to a certain point, any addition of alkali tends to throw down a precipitate. Attempts to raise the p_H of the solution meet with success up to a certain limit. The addition of 60 mg. of dibasic sodium phosphate to 50 c.c. of a 1 per cent solution of "locaine" raised the p_H from 4.7 to 5.0, at which point there appeared a very finely divided suspended precipitate.

Toxicity.—The toxicity was determined by two modes of administration, namely subcutaneous and intravenous. Thus, presumptive evidence was obtained on absorption from subcutaneous tissues and rate of detoxification, and on the possible dangers of clinical application. For subcutaneous injection, albino mice weighing from 15 to 30 gm. were used,

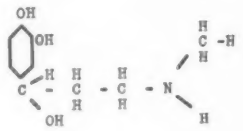
receiving the solution under the skin of the back, near the root of the tail. The resulting phenomena were chiefly convulsive in nature.

The average minimum lethal dose of a 2 per cent "locaine" solution was 825 mg./kg. This compares favorably with Dr. Alles and Knoefel's findings. (Fig. 1.) Their observations were based on injections made with molal amounts in equimolecular concentrations. The data been shown by Eggleston and Hatcher[5] that cats react essentially as dogs do to administration of local anesthetics.

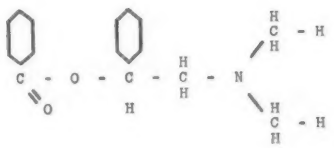
All of the operative procedures on the cats were carried out with a general anesthetic (chloralose), 75 mg./kg. by body weight, given intraperitoneally, with warm water as a vehicle. The basal anesthetic chloralose maintained a constant level of anesthesia, adequate for all surgical purposes, for many hours, no pre-



PROCAINE.



EPINEPHRINE.



"LOCAINE."

Fig. 1.—Structural formulae of procaine, epinephrine and "locaine."

concerning the toxicity by the intravenous mode of administration in cats follow.

Method.—Cats were used, since they more closely resemble man in their responses to many drugs than do rodents. Dogs were not used because, owing to their larger size and consequent need for larger dosage, there would have been an insufficient supply of the drug. It has liminary etherization being necessary.

In all of the experiments on cats, the local anesthetic was dissolved in 0.85 per cent sodium chloride solution. All of the

5. Eggleston, C., and Hatcher, R. A.: Pharmacology of Local Anesthetics, J. Pharmacol. & Exper. Therap., 13:433 (Aug.) 1919. Eggleston, C., and Hatcher, R. A.: Pharmacology of Novocaine, J. Pharmacol. & Exper. Therap., 8:385, 1916.

solutions were freshly prepared on the day on which they were used. In fact, most of the solutions were used within one hour of their preparation.

When an intact animal, anesthetized with chloralose or a barbiturate, is injected with a local anesthetic, such as procaine, the primary effect is paralysis of the respiration, the circulatory failure being secondary. If the injection is discontinued as soon as respiration fails, and artificial respiration is instituted, the circulation is apparently unimpaired. The respiratory center quickly recovers and artificial respiration can then be discontinued.

Procaine and cocaine are either fixed, eliminated or destroyed by the liver, according to Eggleston and Hatcher, but the elimination of these drugs occurs at different rates. The experiments can be repeated several times on the same animal even though every injection has been toxic enough to produce temporary failure of respiration. Forty-five minutes after the administration of the chloralose anesthetic, the animal is ready for operation. It is placed on its back and tied to a board, and the fur is trimmed away from the areas to be operated on. A rubber bag partially filled with air is adjusted over the chest of the animal and maintained by means of a suitable jacket. A rubber tube leads from the rubber bag and is attached to a rubber diaphragm with a recording arm, adjusted to a mov-

TABLE 3.—INFILTRATION ANESTHESIA

Patient	Type of Injection	Amount Injected C.c.	Time of Onset of Anesthesia Minutes	Teeth Extracted	Degree of Anesthesia	Remarks
1	Infiltration	2.0	3.0	5 |	Complete	Satisfactory
2	Infiltration	2.0	3.0	| 4	Complete	Anesthesia incomplete after fifteen minutes
3	Infiltration	2.0	2.5	| 5	Complete	Anesthesia incomplete after fifteen minutes
4	Infiltration	2.0	3.0	| 4	Incomplete	Inflamed soft tissue after forty-eight hours
5	Infiltration	2.0	1.5	4 |	Incomplete	Incomplete
6	Zygomatic	2.5	2.5	| 678	Complete	6 Incomplete anesthesia
7	Infiltration	2.0	3.0	| 3	Incomplete	Incomplete
8	Infiltration	3.0	1.5	| 12	Complete	Satisfactory
9	Zygomatic	2.5	3.0	| 8	Incomplete	Incomplete
10	Zygomatic	2.5	3.0	6 |	Incomplete	Incomplete
11	Infiltration	2.0	2.0	4 |	Complete	Anesthesia incomplete after five minutes
12	Zygomatic	3.0	4.0	| 8	Incomplete	Incomplete
13	Infiltration	2.0	3.0	| 5	Complete	Satisfactory

ing kymograph drum for the purpose of recording depth and rate of respiration. Blood pressure and heart rate are also registered on the kymograph by the usual method. The anesthetic solution is injected into the exposed femoral vein by a 22-gage needle in a 2 c.c. Luer syringe.

In the rapid intravenous injection method, the local anesthetic to be used is injected into the vein as rapidly as the capacity of the vein will permit.

In the slow intravenous injection method, the local anesthetic is delivered at the rate of 1 c.c. per minute and is kept as nearly as possible at a constant rate of flow. The apparatus consisted of a buret fitted with a Mariotte tube, and connected by a cannula to the femoral vein. A very accurate delivery was maintained by counting the number of air bubbles passing through the solution from the Mariotte tube fixed in the buret. The rate of delivery was so adjusted that during the passage of eight bubbles through the solution, 1 c.c. of solution would be delivered by way of the tubing and cannula to the receiving vein.

If death occurs during the injection, the lethal dose can be estimated. The method not only provides for the determination of the effects of individual sublethal doses, but also makes possible duplicate estimations of such effects. By this method, the rather wide variation in the average effects of specific dosages shown by different animals of the same species is eliminated. This agrees with the statements made by MacDonald and Israëls.[6]

A severely toxic, but not fatal, dose of procaine or "locaine" rapidly injected into the femoral vein produces the same general symptoms. Within a few seconds, there is a cessation of respiration and an abrupt fall of blood pressure. The heart rate varies throughout the period. At first, immediately after the fall in blood pressure, the rate is usually slowed, and there is an increased intensity of contraction of the heart. The respiration usually stops for about thirty seconds, or may continue to show stimulation, in both rate and amplitude. Later, the heart beat begins to improve and the blood pressure rises to normal, or even above normal for a short period of time. At about the same time, there are usually several brief

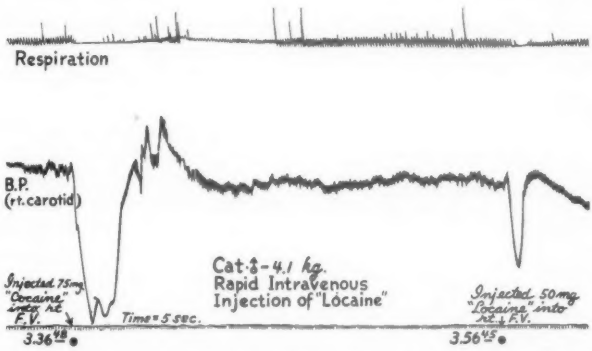


Fig. 2.—Effect on blood pressure and respiration of rapid injection of "locaine" into femoral vein of cat.

6. MacDonald, A. D., and Israëls, M. G.: Local Anesthetics, J. Pharmacol. & Exper. Therap., 44:359 (March) 1932.

but severe clonic convulsions, but, within five minutes, the animal returns to normal. The length of time required for the onset of symptoms does not differ materially for procaine or "locaine" or for doses of different size, as long as the dose is toxic.

The effects on the heart and blood pressure and on the respiration and time of recovery are illustrated in the kymograph recording shown in Figure 2, nearly a fatal vein dose having been administered in the first injection.

With the new local anesthetic, it has

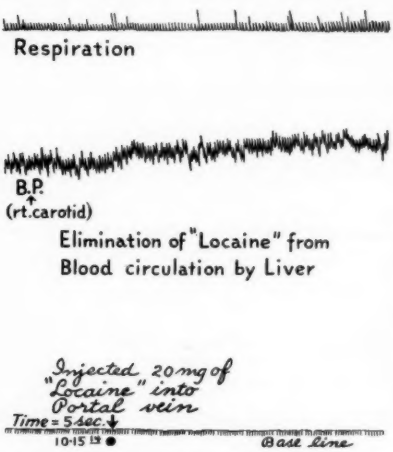


Fig. 3.—Effect on blood pressure and respiration of rapid injection of "locaine" into portal vein of cat.

been found that the average minimal lethal dose for "locaine" injected rapidly intravenously was found to be about 20 mg./kg. It has been found to be twice as toxic as procaine, but not nearly so toxic as cocaine when injected intravenously.

ELIMINATION OF "LOCAINE" FROM THE BODY TISSUES AFTER INJECTION

It has been demonstrated experimentally by Hatcher and Eggleston that the liver actually will fix, destroy or eliminate procaine rapidly if a solution of it is perfused through the liver a number of times.

The following work will demonstrate that the action of "locaine" is likewise affected by the action of the liver. The experimental procedure was simplified in the following work on "locaine." In the work performed by Hatcher and Eggleston, the liver was washed nearly free from blood by passing Locke's solution through the portal vein. The liver was then removed from the body and perfused at a constant temperature for one hour and twenty minutes with a solution of procaine and defibrinated blood, previously removed from the animal. The perfused fluid was oxygenated constantly and later tested biologically by injection.

In the following work, a laporotomy was performed, and the liver was allowed to remain intact in the animal. The solution was injected into the liver by way of the portal vein. Twenty minutes after injection, a solution was introduced into the jugular vein so that comparisons could be made on the effect on respiration and blood pressure. The effects are recorded on the kymograph recordings in Figures 3 and 4.

It will be noted that injection of 20 mg. of "locaine" into the jugular vein was attended by a fall in blood pressure, and subsequent injection of 80 mg. of "locaine" into the portal vein had no marked apparent effect.

INFILTRATION AND BLOCK ANESTHESIA DEMONSTRATED IN THE ORAL CAVITY OF A DOG

In the effort to ascertain the possible dental application of "locaine," the following experiments on dogs were undertaken.

Infiltration Anesthesia.—One-year-old

dogs in good health, and with teeth in good condition, were used in the following experiments. The animal to be worked on was placed in a box, the legs being tied to the sides of the box and the head so fixed that it was allowed slight movement. A section of rubber hose was adjusted in the animal's mouth in the region of the posterior teeth, between the upper and lower arches to prevent closure of the jaws. A rubber dam was then placed from cuspid to cuspid, thus isolating the eight anterior teeth. The pulp vitality of these teeth was tested by means of the Cameron electric pulp tester. This method, although open to several objections, was accurate enough for this experiment. The dog responded to the electric stimulus between resistance 8 and 9 when the control of the rheostat was advanced to that degree. The rubber dam was then reflected so as to expose the labial and palatal mucous membrane. The tissue overlying the roots of the upper left central and first and second lateral incisors was infiltrated with a 2 per cent procaine-hydrochloride solution containing 1:25,000 epinephrine. Approximately 4.5 c.c. was used on the labial and 0.5 c.c. on the palatal surface. The injected mucosa blanched immediately. The rubber dam was again fixed in place. Within a period of from four to five minutes, a sensitivity test was made of the upper left incisors (using the Cameron pulp tester). The control was gradually advanced to resistance 12 on the pulp tester without any response from the animal. The reaction to the pulp tester was checked periodically against the unanesthetized cuspid on the same side.

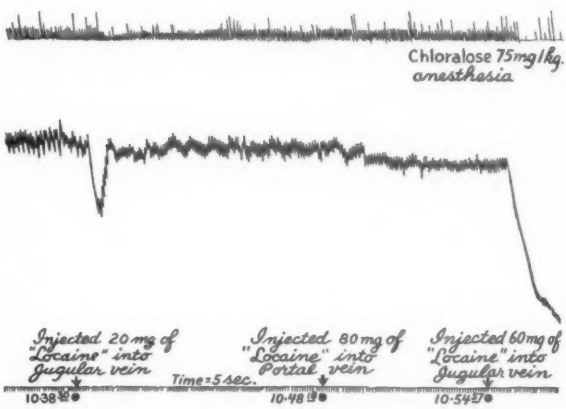


Fig. 4.—Effect on blood pressure and respiration of rapid injection of "locaine" alternately into jugular and portal veins.

The rubber dam was again reflected from the anterior teeth, the upper right central and first and second lateral incisors being used for the injection. The same procedure was followed as in the first part of the experiment, the same quantities of solution being used, but a 2 per cent "locaine" in place of the procaine-hydrochloride solution. There was some blanching immediately on injection of the solution, but not so much as in the case of the procaine-epinephrine solution.

The rubber dam was replaced and, after the same interval of time, the pulp tester was again applied. The control was advanced to resistance 12 without any response from the animal. The upper right cuspid reacted promptly to the electrical stimulus. Fifteen hours later, the tissue appeared to be slightly inflamed in the region anesthetized by the procaine solution and, thirty-six hours later, sloughing was noticed. The tissue appeared to be normal in the region injected by the "locaine" solution. After seventy-two hours, the tissue appeared to be normal in both regions injected by the anesthetic solutions.

Two weeks later, the foregoing experiment was repeated with the same animal and the same procedure except as to the amount of solution. In this experiment, procaine-hydrochloride containing 1:25,000 epinephrine solution was injected for the three anterior teeth in the upper left arch, 0.5 c.c. on the labial aspect and 0.25 c.c. on the lingual. Anesthesia was obtained in between four and five minutes. The duration of anesthesia was approximately forty minutes for the left central and sixty-five minutes for the first and second left lateral incisors. A 2 per cent procaine-hydrochloride solution, without epinephrine, was used for the three anterior teeth in the upper right arch. The duration of anesthesia was approximately forty-five minutes for the three teeth.

Table 4.—Block Anesthesia

Patient	Type of Injection	Amount Injected C.c.	Time of Onset of Anesthesia Minutes	Teeth Extracted	Degree of Anesthesia	Remarks
1	Mandibular	3.0	7.0	| / 5	Complete	Satisfactory
2	Mandibular	3.0	4.5	321 | / |	Complete	Anesthesia incomplete after fifteen minutes
3	Mandibular	3.0	8.0	| / 123	Complete	Satisfactory
4	Mandibular	3.0	5.0	| / 6	Complete	Anesthesia incomplete after five minutes
5	Mandibular	3.5	4.0	| / 874321 |	Complete	Anesthesia present for fifty-five minutes
6	Mandibular	3.5	3.5	| / 5 |	Complete	Satisfactory
7	Mandibular	3.5	4.5	| / 4 |	Complete	Satisfactory
8	Mandibular	3.5	7.0	| / 631 |	Complete	Anesthesia incomplete after twenty minutes
9	Mandibular	3.5	7.5	| / 6 |	Complete	Satisfactory
10	Mandibular	3.5	5.0	| / | 8	Complete	Satisfactory

Block Anesthesia.—Block anesthesia was demonstrated in the dog by giving injections of anesthetic solutions at the base of the tongue in the region of the lingual nerve and on the medial surface of the ramus opposite the mandibular foramen. In the region of the inferior dental nerve, 2 c.c. of a 2 per cent pro-

caine-hydrochloride solution containing 1:25,000 epinephrine was injected. Partial anesthesia of the tongue resulted. There was complete anesthesia of the border of the tongue and partial anesthesia over the greater portion of the dorsal surface of the tongue. No anesthesia was noticed on the posterior part of the tongue, this probably being due to the various nerve supplies to the tongue. The degree of anesthesia was determined by inserting a sharp needle in or pricking the tongue. The results for onset of anesthesia follow: The average time of onset of anesthesia using procaine-hydrochloride was eleven minutes. The average time of onset of anesthesia using "locaine" was thirteen minutes.

CLINICAL STUDY OF "LOCAINE" (TABULAR RESULTS IN DENTAL CLINIC)

Mandibular "block" anesthesia was demonstrated by injecting a 1 per cent "locaine" solution in the vicinity of the mandibular nerve, opposite the mandibular foramen. The onset of anesthesia was determined by testing the sensitivity of the terminal nerve fibers on the lower lip, on the injected side, by pinching with a pair of tweezers and comparing the sensitivity with that of the unanesthetized side of the lip.

Infiltration anesthesia was demonstrated by injecting a 1 per cent "locaine" solution in the soft tissue immediately adjacent to the tooth to be extracted. The onset of anesthesia was determined by inserting a chisel, at thirty-second intervals, between the soft tissue and the tooth to be anesthetized. The foregoing injection technics are those used at the University of California Dental College, as described by C. D. Gwinn.

The results observed on patients in the dental clinic are tabulated in Tables 2 and 3.

The average time of onset of block anesthesia using a 1 per cent solution of "locaine" was five and six-tenths minutes.

The average time for the onset of infiltration anesthesia using a 1 per cent solution of "locaine" was two and seven-tenths minutes.

The foregoing average times may be compared with a series of injections made at the University of California College of Dentistry Extraction Clinic using an alkalinized procaine-hydrochloride solution. The times given, being repeated from the results given in a paper "The Effect of Hydrogen Ion Concentration in Local Anesthetic Solutions," by Gwinn and Ferber,[7] were three and seven-tenths minutes for the onset of block anesthesia using a 2 per cent procaine solution as compared to five and six-tenths minutes for "locaine"; and one and one-tenth minutes for the onset of infiltration anesthesia using a 2 per cent procaine solution as compared to two and seven-tenths minutes for "locaine." It will be necessary to point out the fact that the foregoing determinations were made with a 1 per cent solution of "locaine" in comparison to a 2 per cent alkalinized procaine solution. The reason for this is that it was previously determined that "locaine" has approximately twice the toxicity of procaine.

The topical effect of "locaine" on the oral mucosa was next determined by placing the dry powder on the mucosa of the lip. The sensitivity was tested with a pointed pencil. Cocaine was used as a standard of comparison. The onset of anesthesia produced by "locaine" was between four and five minutes, approximately two minutes slower than the time for onset with cocaine. The duration of anesthesia produced by "locaine" was be-

7. Gwinn, C. D., and Ferber, E. W.: Effect of Hydrogen Ion Concentration in Local Anesthetic Solutions, J.A.D.A., to be published.

tween twelve and fifteen minutes, approximately ten minutes slower than the duration of anesthesia produced with cocaine. The topical anesthetic effect produced by the use of "locaine" appeared to be as profound as that produced by the use of cocaine.

Preliminary experiments are being carried out on the use of "locaine" as a desensitizer of the dentinal fibrils.

Present results are highly satisfactory, pointing to the possibility of using "locaine" as a topical anesthetic during cavity preparation in hypersensitive teeth.

SUMMARY

1. "Locaine" is capable of acting on nerve tissue in a circumscribed area, either by topical application or by injection into the tissues, and produces a paralysis which temporarily inhibits the nerve conductivity without causing permanent tissue injury.

2. Anesthesia produced by use of an alkalinized "locaine" solution is slower than that produced by use of an alkalinized procaine solution.

3. Anesthesia produced by use of "locaine," when injected in the tissues, is not so profound as that produced by use of procaine. When "locaine" is applied directly as a topical anesthetic to oral mucous membrane, it compares very favorably with cocaine, and of course is greatly superior to procaine.

4. The duration of anesthesia is shorter than that produced by the use of procaine.

5. There were no noticeable general toxic symptoms following the use of "locaine." There was a slight degree of local inflammation immediately in the vicinity of the needle puncture, in practically all of the infiltration injections, due probably to the relatively low hydrogen-ion concentration of the solution.

6. The vasomotor activity of "locaine" is not so pronounced as that produced by use of a procaine solution containing 1:50,000 epinephrine.

The proper dental application of "locaine" in the clinic requires the avoidance of too rapid injection into the tissues. If it is administered in quantities equivalent to one-half the strength and amount of procaine generally used, there is no necessity for any greater precaution.

PRACTICABILITY OF CHROME NICKEL ALLOYS FOR ORTHODONTIC USE

By HOWARD YOST, D.D.S., Grand Island, Nebr.

THE title chrome nickel alloys is chosen for base metal alloys of chromium, nickel and steel because it more nearly describes the character of alloys having the highest resistance to galvanic action or electrolysis.

For the past three years, I have used these base metal alloys; first, stainless steel, and later the U. S. S. 18-8 (nonmagnetic) alloys. Attention was first attracted to these alloys because of the high resilience and flexibility of the wire form used in the construction of orthodontic arch wires; and also to the band material in its annealed (dead bend) state, because of its pliability and the inherent quality of

gaining temper through cold working during the process of manipulation in fitting bands, either directly on the teeth or on dies. Material for bands may be obtained for molars in 0.006 by 0.18 inch and for anterior teeth in 0.003 by 0.15 inch and 0.004 by 0.17 inch. Also, seamless contoured molar bands are furnished and, by the use of suitable band stretchers, make the fitting of a molar band not only quick and easy, but also of a greater degree of accuracy.

When the strip form of band material is used, a lap of from 1.5 to 2 mm. is used in spot welding the ends. The band material is pinched around the tooth to be banded, with a suitable band pinching pliers, then cut short of this measurement about 1 to 1.5 mm. to insure that the welded band will be a trifle too small to fit the tooth. Then, by stretching the band over the tooth with band seating instruments or by band stretchers, and by proper contouring and fitting, the band is made to fit the tooth with less effort and time than in my experience with any of the other metal alloys.

Records now show that upwards of 400 bands of this material are now in use on molar teeth and a greater number on anterior teeth. All bands on anterior teeth have spot weld lap joints and about one half the molar bands. The remaining molar bands are seamless contoured bands. Our records show that there has not been a single case wherein a band has separated at the welded joint, nor has there been any corrosion at the joints.

Suitable attachments for engaging arch wire may be procured by spot welding to the bands, or the attachments may be soldered. Preference is given to the spot weld attachments because of ease in attaching and the facilities afforded by positioning to proper alinement while welding.

Perhaps the greatest difficulties in the use of these alloys are encountered in the technic of soldering. I am not in accord with the advocacy of 100 per cent spot welding when it comes to arch wire construction with the necessary auxillary wires for tooth movements. Soldering is in reality quite simple for attaching wires of a smaller gage to larger wires or even wires of the same gage. The soldering operation in itself can be accomplished in less time than is required for the gold alloys. Less heat is required from the blow pipe because this alloy is a poor conductor of heat. Naturally, the heat is confined to the area to which it is applied and the solder flows more quickly as a result thereof. From my experience in several thousand soldering operations, it seems best to use as little heat as possible, keeping the air pressure in the blowpipe at a minimum, and producing a round tipped flame instead of a sharp pointed flame. It is best to hold the area to be soldered higher than the flame and, while the flux fuses on the wire, gradually approach the tip until the solder melts. Eighteen-carat solder will flow in this manner, even in a small alcohol flame.

If an excess amount of flux is used in the soldering operation, little if any oxidation of the metal occurs, the flux having fused to a considerable distance each direction from the point to be soldered and beyond the area of heat conduction to cause oxidation. Should oxidation occur, the deposit can readily be removed by use of a small knife blade, the bead of flux surrounding the soldered joint being scraped away at the same time. After a few touches to the lathe with a cloth wheel in which an abrasive has been incorporated, the soldered joints take on a high polish. It is unnecessary to boil the deposit away in acid and I have eliminated the acid jar completely in my office.

Experience has proved that the higher carat gold solders are preferable for this

technic and 18-carat is now used, which gives no corrosion at the joint and only a slight tarnish in certain mouths, which might be expected from solder on gold alloys. The slight softening of the wire from soldering is readily overcome by retempering through the vibrations imparted in polishing on a high revolving cloth or brush wheel. All small gage auxiliary spring wires are, in addition, wrapped two or three times around the base wire before their extension into finger springs.

Soldering may be almost entirely disregarded if we so desire. By a little ingenuity, one can construct an entire lingual arch, including posts, locks and all manner of auxiliary springs from two pieces or even one piece of wire. When more than one wire is used, the auxiliary springs are attached to the base wire by a method of wrapping. Likewise labial arches can be so constructed in one piece by use of open loops and the bending (through heat treatment) of the wire on itself to form hooks, spurs, etc.

When chrome alloy receives the same care in preparation in its finish and final polish that any other metal should receive before being put into the mouth of a human being, I cannot conceive of a better substitute. Among other advantages that it does possess over the gold alloys is the fact that the gingivae and soft tissues of the mouth show a greater tolerance to it than to gold alloys. There is a freedom from adherence of plaques and débris to this metal, which cannot be said for gold. In addition to the abovementioned qualities of this metal, appliance construction is accomplished in about one third to one half the time; which is a decided economic advantage to the busy orthodontist. Also, the frequency of treatment is reduced because of greater flexibility of appliances, made possible by the use of smaller gage wires.

I do not in any sense consider chrome alloys a substitute for gold alloys, but an evolutionary product of progress. In the light of my experience to date, I would not change back to gold alloys. It has been argued that the reason for the increased one third to one half the time; which is their attractive price, but when one takes into consideration the value of orthodontic gold scrap material, there can be little if any difference in material costs.

Dental materials are not used for their material worth in dollars and cents. The inherent and intrinsic value as a means to the attainment of professional perfection can be the only excuse for the choice of materials employed. It is this reason alone that chrome nickel alloy (nonmagnetic) is among the materials available today for orthodontic practice, the material *par excellence*.

404 First National Bank.

MEDIAN ANTERIOR MAXILLARY CYSTS*

By EDWARD C. STAFNE, D.D.S.; LOUIE T. AUSTIN, D.D.S., and BOYD S. GARDNER, D.D.S., Rochester, Minn.

CYSTS are not of uncommon occurrence in the mandible and maxilla and heretofore it has been assumed that almost all of them have been derived from the dental system. There is another cyst about which, very strangely, little has been known, and which probably occurs with greater frequency than those of dental origin. This is the median anterior maxillary cyst, which is situated in the anterior palatine canal. While cysts in this region had previously been removed, it was not until 1931,[1] when Meyer reported an incidence of one in sixty-six, as determined by dissection of 600 cadavers, that it was known that they were common.

In view of the fact that these cysts are so common, other anatomists no doubt have encountered them. As anatomists, they are chiefly concerned with the normal, and many of these cysts probably have been seen and totally disregarded. In a series of roentgenograms of adults, Meyer[2] found what he considered definite roentgenographic evidence of such cysts in one of every eighty-eight cases. This finding is to be expected, for it is more difficult to make a positive diagnosis with roentgenograms than it is with actual dissection. The incidence of these cysts at The Mayo Clinic, which is determined from roentgenologic evidence, was in no instance less than one in every 100 patients.

The first report of a cyst of this nature was made by Meyer, in 1914. It was found in a cadaver in which median sections were being made. The teeth were normal, and dental abscess was excluded as an etiologic factor. In 1920, Congdon[3] reported another, which was 9 mm. in height, 5.5 mm. in anteroposterior diameter and 8.5 mm. wide. This one was also found in making sagittal sections in the dissecting room. The contents were mucoid, and a cyst 2 mm. in diameter was seen in the right wall of the larger cyst. No communication with the teeth was found. The wall of the cyst was fibrous and the lining consisted of columnar epithelium. In 1928, Kronfeld[4] reported one which was 8 mm. in length and 6 mm. in width and which occupied the oral portion of the anterior palatine canal. The wall of the cyst was lined with stratified squamous epithelium, and

*From the Section on Dental Surgery, The Mayo Clinic.

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-Seventh Annual Session of the American Dental Association, New Orleans, La., Nov. 6, 1935.

1. Meyer, A. W.: Our Inadequate Terminology Concerning Anterior Palatine Region, Anat. Rec., 49:19-30 (March) 1931. Median Anterior Maxillary Cysts, J.A.D.A., 18:1851-1877 (Oct.) 1931.

2. Meyer, A. W.: Spolia Anatomica: Unique Supernumerary Para-Nasal Sinus Directly Above Superior Incisors, J. Anat. & Physiol., 48:118-120 (Jan.) 1914.

3. Congdon, E. D.: Supernumerary Paranasal Sinus, Anat. Rec., 19:367-371 (Nov.) 1920.

4. Kronfeld, Rudolf: Histopathology of Teeth and Their Surrounding Structures, Philadelphia: Lea and Febiger, 1933, pp. 406-410.

no evidence of inflammation could be found in the specimen. Since that time, Kronfeld has observed another one, in an edentulous human maxilla. Schroff,[5] in 1930, reported four cysts, one of which was found in an edentulous patient. All of these patients came to his attention because of associated symptoms such as swelling, pain and drainage. The cysts were removed surgically. Two pointed labially; two, palatally. In one case, the cyst was lined by a well-defined squamous epithelium.

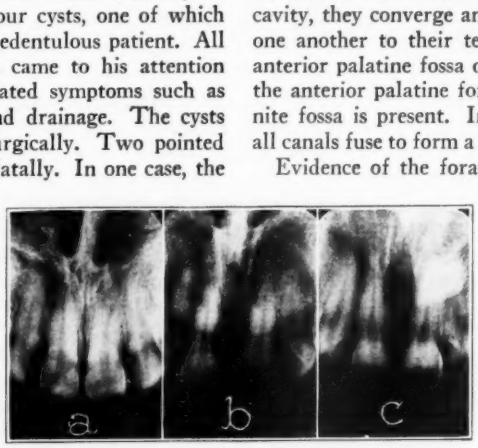


Fig. 1.—Anterior maxillary region. *a*, superior anterior palatine foramina; *b*, lateral walls of anterior palatine canal; *c*, anterior palatine fossa.

Fig. 2.—Median anterior palatine cysts: *a*, directly in median line and probably situated in a common canal; *b*, in right major canal; *c*, bilateral occurrence in major canals; *d*, in edentulous maxilla.

The anterior palatine canal system usually consists of four canals: two minor anterior palatine canals (Scarpa), which are median, and two major anterior palatine canals (Stensen), which are lateral canals. As the canals extend downward and forward from the nasal cavity, they converge and run parallel to one another to their termination in the anterior palatine fossa or at a point near the anterior palatine foramen, if no definite fossa is present. In some instances, all canals fuse to form a common canal.

Evidence of the foramina, canals and fossa is often seen in the roentgenogram. In some instances, two distinct superior anterior palatine foramina, one on either side of the nasal septum, may be seen in the usual direct anterior roentgenograms of the central incisor region (Fig. 1 *a*). More often, one foramen only is seen in the anterior view, and that is more apt to occur when there is a marked deviation of the nasal septum. It is not uncommon

5. Schroff, Joseph: Cysts in Incisor Canal: Further Studies of Pathologic Conditions in Region of Naso-Palatine (Incisor) Canal and Papilla Palatina, J. D. Res., 10:739-762 (Dec.) 1930.

to see evidence of one foramen in roentgenograms of the cuspid region which have been made in the customary manner.

When the canal is sufficiently large, evidence of the canal may be seen as fine radiopaque lines which extend downward from the nasal floor and fade away before they reach the alveolar crest. These lines are seen laterad from and parallel to the median suture line, representing the lateral borders of the right and left major canals or the lateral borders of a common canal, as the case may be (Fig. 1 *b*). In roentgenograms of the upper cuspid region which have been made in the customary manner, the anterior palatine canal is often seen superimposed on the roots of the central incisor teeth.

The anterior palatine fossa and foramen are frequently seen in the dental roentgenogram. They are usually situated near the crest of the alveolar ridge. They vary markedly in size, and the image of the anterior palatine fossa is usually elliptical (Fig. 1 *c*).

While it is probably impossible from the roentgenographic evidence to distinguish a small cyst in the lower portion of the anterior palatine canal from an anterior palatine fossa, there should be no difficulty in distinguishing the anterior palatine fossa from large cysts in the anterior palatine canal. The image of the posterior margin of the anterior palatine fossa rarely extends as high on the roentgenogram in relation to the apices of the roots of the central incisors as do the cysts. The margins of the anterior palatine fossa are rarely well defined, while those of the cyst are usually definitely outlined. There is also a marked tendency for the cysts to become spherical, and some of them present a roentgenologic image that is almost a perfect circle.

From observations, the majority of median anterior maxillary cysts as seen in the dental roentgenograms are situated directly in the midline and extend laterally to the right and the left about equal distances (Fig. 2 *a*). Whether the cysts that are so situated originate in a common canal is problematic. Those that extend laterally to one side only and do not cross the midline to the opposite side probably originate in the lateral or major canal on the involved side (Fig. 2 *b*). In rare instances, two distinct and separate cysts are seen, one on either side of the midline. Such an occurrence suggests cysts in both of the major or lateral canals, cysts which have developed independently of one another (Fig. 2 *c*). The presence of two cysts cannot always be demonstrated in the roentgenogram, particularly if

Fig. 3.—Median anterior maxillary cyst from which there had been a fistulous opening to palatal surface for fifteen years, *a*, cyst; *b*, fistulous opening.

they are partially superimposed on one another, and an occurrence bilaterally may be more common than is suspected.

It naturally follows that the incidence of median anterior maxillary cysts is as high in the edentulous maxilla as in the maxilla in which the teeth are still present, and they are probably more easily recognized in the roentgenogram of the edentulous maxilla. Such a cyst may account for a marked protuberance that occasionally occurs on the alveolar ridge in the midline. Failure of the bone directly overlying the cyst to become resorbed when extensive resorption of the remainder of the alveolar ridge has taken place accounts for this protuberance, al-

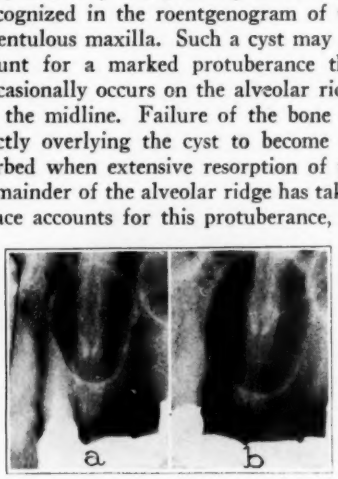


Fig. 4.—Two views of case taken (*a*) in 1925 and (*b*) in 1933.

though it is also possible that the protuberance may result from recent growth of the cyst itself. It is difficult to understand why there is so rarely any trouble associated with such a condition, when one considers the amount of stress that is brought to bear on this prominence by artificial dentures, particularly those dentures which have not been readjusted in consideration of the resorption that has taken place. A cyst with no associated symptoms that produced a marked prominence on the alveolar ridge is shown in Figure 2 *d*. A roentgenographic examination with such cysts in mind is no doubt indicated in cases in which there is localized or referred pain in the anterior region of the maxilla.

A median anterior maxillary cyst from which there had been an opening into the palatal surface for a period of fifteen years is shown in Figure 3 *a*. This cyst was seen in a man, aged 66, who had generalized vascular and cerebral arteriosclerosis. The Kline, Hinton, Kahn and Kolmer tests were negative. There was a history of an acute infection with subsequent drainage into the palatal surface for several weeks. This occurred fifteen years prior to the time that the present photograph was made (Fig. 3 *b*). The opening has been present since that time. A probe could be inserted fully 1 cm. be-

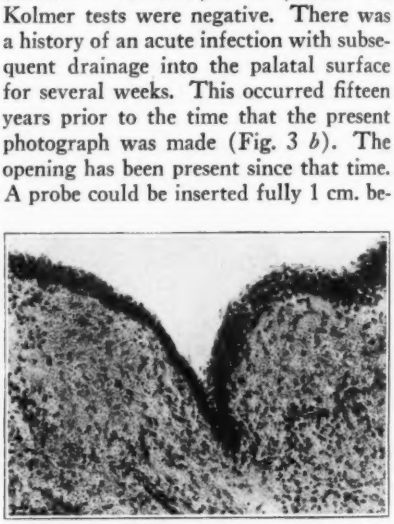


Fig. 5.—Squamous epithelial lining of cyst shown in Figure 4 (×175).

yond the orifice of the opening, and epithelium from the palatal surface extended upward to line the cystic tract. The patient had experienced no discomfort since the infection that produced the opening had occurred. The dental roentgenogram revealed a typical median anterior maxillary cyst directly in the midline (Fig. 3 *a*). The left lateral incisor was negative to vitality tests, and there was also roentgenographic evidence of periapical infection, but the central incisors were vital. Other conditions being favorable, surgical interference is no

doubt indicated in cases such as this, but this particular patient was considered a poor risk and operation was not advised.

REPORT OF CASES

CASE 1.—A man, aged 38, came to the clinic late in 1925. In the course of a general physical examination, a dental roentgenologic examination revealed evidence of a cyst in the median line of the anterior part of the maxilla (Fig. 4 *a*). The cyst had not produced any symptoms, and the patient was unaware of its presence. He said that the missing incisors had been knocked out while he had been playing football about twenty years prior to the time of examination, but it was our opinion that this injury probably was not related in any way to the formation of the

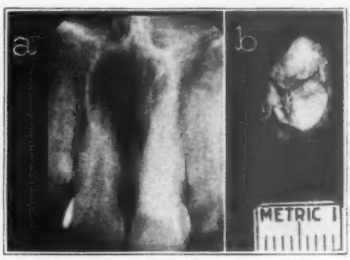


Fig. 6.—Median anterior maxillary cyst. *a*, roentgenogram; *b*, gross specimen.

cyst. Sept. 25, 1933, a dental examination was again made as a part of a general physical examination. The roentgenograms at this time revealed a root in the upper first molar region, and disclosed that eight teeth still were present in the maxilla. Three of these were infected. The cyst that had been noted in the anterior part of the maxilla eight years before had increased markedly in size (Fig. 4 *b*). It was one of the largest cysts of this nature that we have had occasion to see. There was no pain present. Removal of the remaining upper teeth was indicated, and removal of the cyst was also advised. The cyst, which was filled with a thin fluid, was removed from the palatal surface. Some difficulty was experienced in enucleating it because of its thin wall, and it was impossible to remove it intact. Microscopic examination revealed a relatively thin wall of fibrous tissue that was lined throughout with squamous epithelium (Fig. 5). The large size of the cyst probably accounts for the thinness of the wall.

CASE 2.—A man, aged 24, came to the clinic in 1932, suffering from ulcerative colitis. A complete roentgenologic examination was requested by his examining physician in the course of the general physical examination. At the time of dental examination, the patient said that he often had experienced pain in the anterior palatine region. The roentgenogram revealed a cyst in the anterior palatine canal (Fig. 6 *a*). The pulp chamber and the pulp canal of the right central incisor were completely obliterated and a communication between the root of this tooth and the cyst was suspected. Removal of the cyst was advised. The soft palatal tissue was retracted posteriorly and a large opening into the anterior palatine canal, which had to be enlarged very slightly to allow enucleation of the cyst, was revealed. The cyst was separated with ease from the wall of the cavity in which it was situated, with the exception of the superior portion, at which point it was found necessary to separate it from the contents of the canal, which extended upward. The good view of the bony cavity had after removal of the cyst revealed no communication with the roots of the incisors. The cyst measured about 1 cm. in diameter (Fig. 6 *b*). There was no anesthesia or apparent ill effects as a result of removal of the nasopalatine nerve and blood vessels.

Microscopic examination revealed a cyst that was lined throughout with a well-defined transitional or cuboidal epithelium (Fig. 7 *a*). In the thick fibrous wall was another small cavity with the contents still in place. This also was lined with well-defined transitional or cuboidal epithelium. The contents of the cavity were mucin, as revealed by carmine stain for mucin (Fig. 7 *b*). An examination of every tenth section throughout the entire

cyst revealed a few daughter cysts. The contents were mucin in all those in which the contents could be demonstrated. Serial sections ruled out any possibility that these small cysts were a part of the main cyst. One of these smaller cysts is illustrated in Figure 7 *c*. The nasopalatine blood vessels and nerves were situated within the fibrous wall of the cyst. Several remnants of epithelium were scattered throughout the fibrous tissue, and in some regions there were large masses of mucous glands (Fig. 7 *d*).

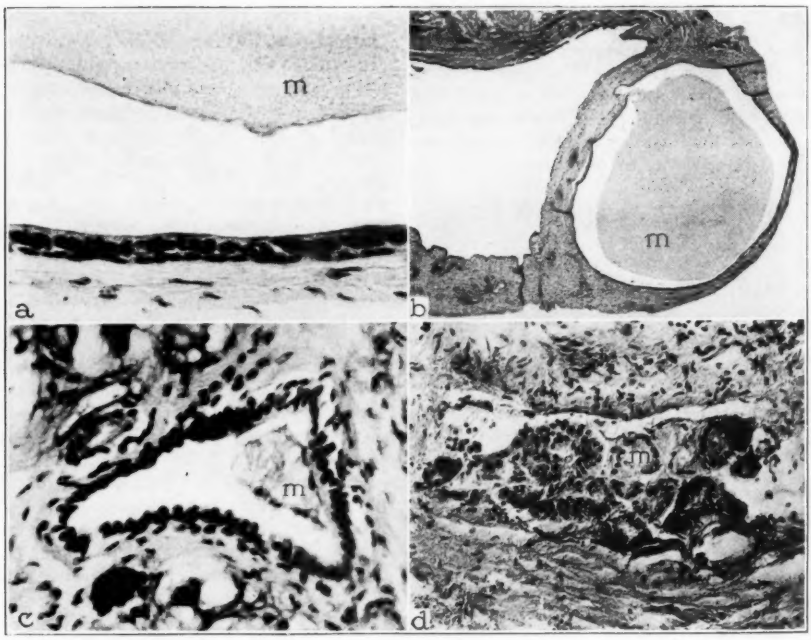


Fig. 7.—Cyst shown in Figure 6. *a*, lining of cuboidal epithelium (×650); *b*, accessory cyst with mucoid content in place (×20); *c*, smaller daughter cyst in wall of larger cyst with mucoid content (×480); *d*, mucous glands (×220).

Case 3.—A man, aged 36, came to the clinic, Dec. 23, 1920, suffering from amebic colitis. A dental roentgenologic examination revealed three infected teeth, which were extracted. The image of a cyst in the median line was probably erroneously interpreted as evidence of a large anterior palatine fossa, for its presence was not noted in the report of the dental examination. The patient returned Oct. 7, 1932, and, in the course of a general physical examination, a tumor of the bladder was found. Dental roentgenograms revealed a pulpless upper left central incisor and a median anterior maxillary cyst (Fig. 8 *a*). In view of a history of drainage at a point immediately posterior to the incisor, extraction of the tooth and removal of the cyst were advised. Shortly thereafter, the tooth was extracted elsewhere, but the cyst was not disturbed. The patient again returned to the clinic, Sept. 29, 1933, for a medical examination, and a dental roentgenogram was made (Fig. 8 *b*). October 3, the cyst

was removed surgically by enlarging the anterior palatine foramen slightly. The postoperative course was uneventful. A roentgenogram made Oct. 3, 1934, exactly one year after removal of the cyst, is shown in Figure 8 *c*. There is no roentgenographic evidence that the cavity formerly occupied by the cyst has begun to be filled in with bone, and one is led to believe that it will not, when one considers that twelve months had elapsed since the enucleation of the cyst. A microscopic examination of several sections showed that the entire cyst was lined with ciliated columnar epithelium (Fig. 9 *a*). There was a marked infiltration of leukocytes and plasma cells in the wall of the cyst. In Figure 9 *b* is shown an inflammatory region in which the lining of the cyst has been

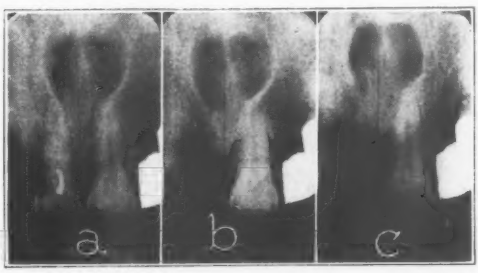


Fig. 8.—Three views of case, made *a*, Oct. 7, 1932; *b*, Sept. 29, 1933; *c*, Oct. 3, 1934.

penetrated and destroyed. An examination of the walls also revealed mucous glands, and a few accessory cysts. Such a small cyst and a mucous gland in the wall of the large cyst is shown in Figure 9 *c*. This small cyst was also lined with ciliated columnar epithelium. A higher magnification of the mucous gland is shown in Figure 9 *d*. A mucous stain revealed mucin.

COMMENT

Meyer suggested that these cysts originate from epithelial remnants that persist in the nasopalatine closure. There is proliferation of these remnants with an accumulation of secretion from cysts that enlarge through pressure atrophy of the surrounding bone. The main epithelial rest in this region is the nasopalatine duct which, in some instances, may be patent. Meyer, who quoted Peter,[6] said that the so-called nasopalatine ducts really are cords, which may form in continuity or in a discontinuous way. From an examination of twenty-nine canals in young fetuses, he concluded that their origin in continuity is relatively rare. Peter found the cords usually divided into three portions: one, a solid sprout extending down from the nasal cavity and composed of the cells characteristic of the nasal cavity; another, extending from the oral cavity and composed of squamous epithelium characteristic of the palate, and a third of degenerated cells in the connective tissue between these two. It has been assumed that the cords, which are readily demonstrated in late fetal life, disappear and are not present in the adult, but that they do tend to persist is suggested by the presence of the relatively large number of cysts that occur in this region.

Assuming that cysts develop from epithelial cords that persist, is there necessarily any relationship between the type of lining found in the cyst and the various types of epithelium found in the three portions of the cord or duct? If this re-

6. Peter, Karl, quoted by Meyer, Footnote 1, second reference.

lationship exists, those lined with ciliated columnar epithelium have their origin from the sprout extending down from the nasal cavity; those lined with transitional epithelium arise from the midportion, and those lined with squamous epithelium arise from the cord extending from the oral cavity.

Grohs[7] said that mucous glands often enter these nasopalatine ducts. If the opening at the palatine end of the duct is closed and the glands produce mucus that cannot be eliminated, a retention cyst may develop.

The presence of small cysts in the walls of the main cysts is of interest when one considers their origin. Meyer, in discussing the origin of the small cyst which occurred in the wall of the cyst reported by Congdon, suggested the possible occurrence of mucous glands in the wall of the cyst, but said that it seemed more likely that the two cysts arose from separate epithelial remnants and later fused. While numerous mucous glands were noted in the walls of the cysts examined at the clinic, there was no definite evidence that the daughter cysts developed from any of them. Whether a mucous gland, such as shown in Figure 9 *d*, with the layer of basal cells surrounding it, has potential ability to develop into a cyst is problematic.

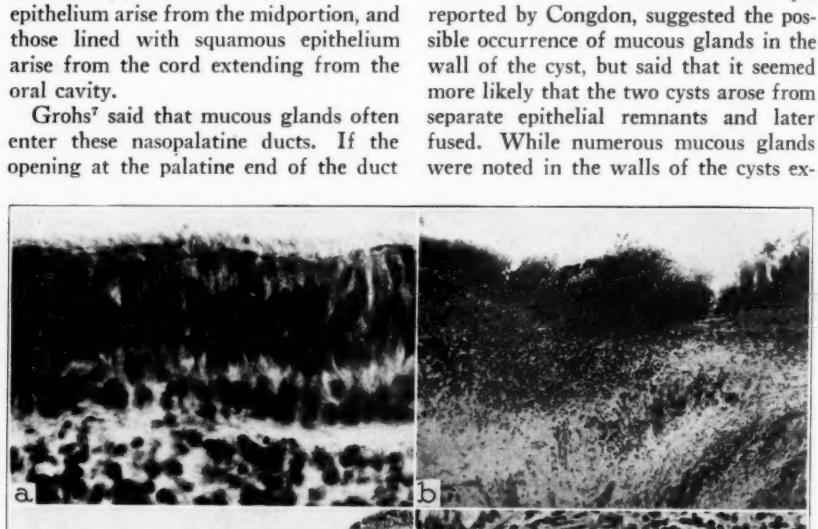


Fig. 9.—Cyst shown in Figure 8. *a*, lining of ciliated columnar epithelium (×610); *b*, area of localized inflammation penetrating epithelial lining (×115); *c*, daughter cyst and mucous gland in wall of cyst (×55); *d*, mucous gland seen in *c* (×340).

7. Grohs, Richard: Epithelial Rests in Region of Palatinal Papilla of Upper Jaw (Abstr.), J. D. Res., 14:187-188 (June) 1934.

It is also possible that epithelial buds may be formed by proliferation and downward growth of the epithelium into the wall of the cyst. Degeneration of the center of such a bud, and final separation from the mother cyst, may result in the formation of a daughter cyst.

This report is made primarily to demonstrate the three different types of epithelium that line median anterior palatine cysts. From microscopic examinations made at the clinic and elsewhere, it is apparent that most of these cysts are lined with squamous epithelium. The roentgenogram is not an aid in predicting the type of epithelial lining present. This is to be expected, for when the cyst can be diagnosed definitely from the roentgenographic evidence, it has reached sufficient size to occupy all or a large portion of the anterior palatine canal.

The cysts are limited as to size. We have had an opportunity to examine an unusually large number of roentgenograms, and few cysts larger than the one illustrated in Figure 5 *b* have come to our attention. The fact that the cyst does not tend to grow beyond certain limits suggests that drainage of the contents to the surface may take place. The drainage may be constant or intermittent, and so scant that it cannot be detected grossly. Such drainage is probably more readily established because the bony cavity that the cyst occupies is not closed, but communicates directly with the oral and nasal cavities. Again, continued growth may be inhibited by pressure on the epithelium itself.

While the majority of these cysts probably are insignificant clinically, there are those that become infected or exert pressure on the nasopalatine nerve and produce pain. In such instances, surgical removal is indicated. Enucleation of the cyst is made with ease from a palatal approach, and there need be no interference with the incisor teeth, if these teeth are present and if one wishes to retain them. Whether one should view cysts in which there is no clinical evidence of infection as possible sources of infection, we are not prepared to say. As yet, we have not felt justified in interfering surgically in the absence of clinical evidence.

There are apparently no unsatisfactory postoperative sequelae as a result of removal, even though the nasopalatine nerves and vessels are necessarily removed with the cyst. In no instance did patients experience any abnormal or peculiar sensations in the anterior palatine region following operation. That there may be a failure of the cavity that formerly was occupied by the cyst to become filled with bone is suggested in one of the cases reported here in which there was no change in the roentgenographic appearance of the cavity one year after removal of the cyst. As the region was not exposed again, the nature of the contents of the cavity was not determined. It is unlikely that the area of radiolucence that persists is evidence of a recurrent cyst. Unlike cysts of dental origin, the bony cavities that these cysts occupy are lined with periosteum, and failure to remove the inner periosteal lining from the surface of the bony cavity at the time of enucleation of the cyst probably accounts for the failure of the cavity to become filled with bone.

The median anterior palatine cyst has not been generally recognized as such in the dental roentgenogram, and the image of these cysts, as illustrated in most textbooks, has been referred to as large anterior palatine fossae. Curiously, those roentgenograms selected to illustrate large anterior palatine fossae are most typical of cysts. A knowledge that median anterior palatine cysts are not of uncommon occurrence is therefore important in dental roentgenologic diagnosis because it rectifies a very common misinterpretation.

MALIGNANT TUMORS OF THE MOUTH*

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THERE is no doubt that the dental profession has, in the last few years, been accepted by the public as a definite member of the health preserving and healing arts. We as dentists can preserve this relation to society just as long as we progress with science and take our place with our co-workers in the battle against the several diseases that are continuously destroying the lives of our friends, neighbors and patients. In glancing over the list of diseases most prevalent in this country, we find: heart diseases, first; cancer, second; kidney disease, third; diseases of the brain, fourth; pneumonia, fifth, and tuberculosis, sixth.

I already hear the question: "Well, what of that? Those are diseases we have little or nothing to do with, so what can we do to assist in this battle?" True enough, we can do little in the case of most of these conditions, but there is one that we can concentrate on and materially assist in controlling. That is the one in the second place: cancer. It has been estimated that there are at the present time more than 500,000 persons suffering with cancer in the United States, of which one fourth die annually.[1] About 4 per cent of the malignant tumors are found in the mouth. (These statistics were compiled in 1930, and the figures are undoubtedly about 10 per cent below the actual number of cancers in our country today.)

With a conservative interpretation of these figures, we find that 20,000 people are suffering with cancer of the mouth, most of whom will go to their dentist for advice before they turn to anyone else for help. If we next consider the precancer conditions of the mouth, we are surprised to find that the number of patients runs into the ten thousands. Perhaps we begin to realize the responsibility placed on us of advising all of our friends and neighbors lest they lose their lives from this dreadful disease.

I use the term "dreadful disease" advisedly, because it is one of the most terrible diseases known to the practice of medicine. Can you show me any disease of the human body which is any more demoralizing to the patient and his relatives than cancer? Do you know of any more unsightly thing than one of these slowly growing, constantly infiltrating, often ulcerating and suppurating malignant tumors that prevent a man from taking his bread and water, and in addition causing pain of an extreme tic douloureux type, making him hope and pray to die? The most pathetic part of this picture is that most of this terrible suffering could have been prevented had the patient sought advice early and been skilfully treated.

I am going to venture a broad statement, fully realizing that I shall be

*Read before the Section on Oral Surgery, Exodontia and Anesthesia at the Seventy-Seventh Annual Session of the American Dental Association, New Orleans, La., Nov. 5, 1935.

1. Cancer Mortality in the United States (Registration Area), Report of the American Society for the Control of Cancer, 1931.

criticized for it, but one that I honestly believe: There is little excuse nowadays for the loss of a life from cancer of the mouth. True enough, there are several different types and one or two are considered incurable. They are found rather infrequently; and I am confident that even those could be cured if diagnosed at an early date and skilfully treated without delay. Whether we are interested in the treatment of cancers or not, it is our job, by virtue of our position in society—it is our responsibility at least—to caution a patient at once and direct him whenever a suspicious lesion is seen within the oral cavity.

There are several sides to consider in meeting this responsibility. We see patients who are actually afraid to learn the truth about a lesion of the mouth, or any other portion of the body, when they have the least idea that it might be a cancer. They delay a visit to the dentist or physician until, almost hysterical from worry or pain, they are literally driven to seek help. Another group seek advice, but offer all sorts of excuses and alibis rather than accept proper care. Of course, we have quacks who prey on cancer patients by applying caustic salves or injecting mystic solutions. I saw one man who had accepted the services of one of these charlatans. He had been treating this patient for a cancer of the lower lip with some caustic salve. After all of the soft tissues covering the anterior two thirds of the mandible had been literally burned away, the patient entered one of our clinics to find that the condition was not a cancer and undoubtedly never had been. Then we have professional colleagues who, although sincere, really watch suspicious lesions too long before making an accurate test lest they may be required to tell a friend that he or she is facing cancer.

Our patients frequently refer to the old statement, "They have not yet found the cause of cancer," and, in the very next breath, they tell of a friend who died of cancer of the tongue that was due to the presence of a badly decayed tooth. That seems to be the extent of their knowledge of the subject. They little know that the term "cancer" is used as a group name for tumors which, of themselves, tend to destroy life. One authority describes more than 200 different kinds of malignant tumors, and, in his clinic, he goes on to group each one of them into eight different types. This gives us practically 1,600 kinds of malignant tumors to consider, each one of which might easily have its own specific group of causes.

Let us consider lesions of the skin. In the skin, there are several layers of cells which are continuously wearing out and must be replaced. To take care of these replacements, nature supplies new cells, which when young (embryonic) are incapable of performing the service of the mature cells, protection to the human body. As these cells grow and mature, they go through several changes or stages, but they may be stopped at any level of their development by many different combinations of conditions and, instead of becoming mature and useful, multiply rapidly in that stage of development until a tumor is formed, and this is a cancer. You see, therefore, that any group of conditions that will keep cells from maturing normally and at the same time permit them to multiply in one stage of maturity is a cause of a cancer. We have scores of these etiologic combinations.

Permit me to illustrate by sighting a basal-cell carcinoma of the cheek. As the superficial layers of the skin on the cheek were wearing away, Nature put in some new cells, which were intended to mature and protect the area. About the

time they had a good start in life, they became retarded because the tissue fluids were not exactly normal from a chemical standpoint. As there was a slight burning sensation in the area, the patient scratched the lesion with her fingernails. As a scab formed, it would be scratched off rather promptly, and, in addition, perhaps the patient rubbed a caustic salve on at nights to heal the wound and applied face powder, to which she was sensitive, during the day. This by no means unusual group of conditions could easily be the cause of a cancer.

In the mouth, the presence of a sharp tooth, a poorly fitting denture, a broken crown, etc., may be a factor in cancer, but there must be other conditions added before malignant tumor will result. On the other hand, precancerous conditions may remain quiescent for years and without malignant change; but we must remember that the tissues of the mouth are easily and almost constantly irritated, and obviously all precancer lesions should be treated before they have a chance to become serious.

Many people, even yet, believe cancers have roots. This idea is, of course, prompted by the statements concerning the theory of continuous permeation of lymphatics during metastasis.[2] In reporting his studies, Handley[3] tells of a very definite progression of metastatic growth from primary cancers. Borrman found that metastatic tumors of the stomach wall which had long been regarded as implantations from cancers of the esophagus were directly connected via the lymphatics with the primary tumors. In other words, he found a continuous column of tumor cells down the lymphatics to the stomach. Bloodgood believed that successful extirpation of cancer of the tongue and infected lymph nodes could be accomplished only by extirpation of the lymphatics joining the ulcer and the lymph nodes. Ewing[2] points out that although these men report such findings, the majority of observers fail to find, in early cases, such uniform continuous connections and are agreed that such metastatic infections are usually by means of emboli. As a matter of fact, metastases from cancer of the tongue often occur in distant nodes, sometimes on the opposite side of the neck. In general, we may say that the rapidly growing epidermoid[4] and glandular cancers usually disseminate by lymphatic embolism, while slow growing and recurring tumors, especially of the skin,[5] extend by continuous permeation.

Each type of cancer has its own characteristics. Their origin, manner of growth and progressive dissemination are as independently characteristic as the habits of a temperamental child.

The human body has a defense mechanism that it uses against these malignant invaders. It seems to be generally believed that cancer cells travel from one part of the body to another at will. Such is not the case. In the first place, some are either too lazy to travel a great deal or have a hard time growing. They are the slow growing types that remain circumscribed for a long time. Then too, cancer cells, bacteria or any other invading substance, such as particles of coal dust, have certain well-guarded barriers, or filtering stations, known as lymph nodes, which they must pass through if they are to be disseminated along the lymphatics. We have evidence of cancer cells being destroyed by lymph nodes for a time, and after these nodes have with-

2. Ewing, James: Neoplastic Diseases, Treatise on Tumors, Ed. 3, Philadelphia: W. B. Saunders Co., 1928, p. 78.

3. Footnote 2, p. 73.

4. Footnote 2, p. 888.

5. Footnote 2, p. 885.

stood the attack of the cancer cells for some time and their resistance is gone, they become a prepared soil for the implantation of cancer cells.

How, then, are we to make a diagnosis of all these conditions? Make a biopsy, having the tissue examined in the pathologic laboratory. That would be a good answer on an examination paper. But permit me to describe this procedure. I have taken tissue from cancers and sent it to excellent laboratories and received a negative report because I did not take the piece of tissue from the right place in the tumor. We do not intend to take a large amount of tissue for this examination. Remember that the cancer cell is a sort of wandering cell; that is, it is capable of moving or being moved from one place to another by the flow of either lymph or blood, or by the pressure exerted on the tumor tissue while a specimen is being taken for biopsy and, of course, the more of an operation we make of the biopsy, the greater the chance of spreading the cancer. We should be careful in this simple procedure. Let us select the location from which we are going to take the specimen. If we want just cancer cells, let us take it from the center of the ulcer or midportion of the tumor. If it is a tumor in the transitional stage of development from a benign tumor and we take the specimen from the very tip of, let us say, a papilloma, we may expect to obtain no cancer cells at all, but if we want to make a biopsy that will give us the most valuable information, it is better to take the piece of tissue from the side of the base where the granulations are to be seen and include a very small amount of normal tissue with it. This sort of specimen will give the pathologist an opportunity to orient himself with the normal adjoining tissues and report on not only the malignancy of the tumor, but also the type of cells involved and the character of the invasion; which, after all, is the type of report most desired.

The amount of tissue needed is a piece about the size of a pea. Sharp instruments should be used, sharp biopsy forceps being the best. Pinching the tumor while holding it to grasp the tissue with the forceps should be avoided, and the specimen should be "picked" from its position. If the operator wishes to use a local anesthetic, an injection will have to be made, but only a small amount is deposited directly into the area from which the specimen is to be obtained.

As for the deeper tumors, such as in a lymph node in the neck, we may take them out for examination or we may make what is known as an aspiration biopsy. This is the procedure of choice with tumors lying below the surface of normal tissue where tissue cannot be obtained except by surgical incision through normal tissue. Hayes E. Martin and Edward B. Ellis,[6] of the Memorial Hospital, New York, first described the procedure in 1930 and made a report on it again in 1934. They describe their technic as follows:

The skin at the site intended for puncture is painted with iodine and a small area of skin is infiltrated with 1 per cent procaine. In particularly sensitive regions, some of the local anesthetic is injected along the line of intended puncture down to the tumor. With a bistoury pointed scalpel (No. 11 Bard Parker blade), a stab wound is made with the instrument held at right angles to the skin. This puncture of the skin facilitates the insertion of the needle and prevents the contamination of the aspirated material with surface epithelium. An 18-gage needle tightly fitted to a 20 c.c. record syringe (with the piston closed)

6. Martin, H. E., and Ellis, E. B.: Surg. Gynec. Obst., 59:578-589 (Oct.) 1934.

is then inserted through the superficial tissues until the point is felt to enter the neoplastic mass. When the needle is guided by palpation with the disengaged hand, it is striking how readily a difference in consistency of the tissue can be felt as the point of the needle enters the mass. When the point of the needle is within the tumor, the piston of the syringe is partly withdrawn to produce a vacuum and the needle is advanced 1 to 3 cm. farther, depending on the structure and size of the tumor. The needle is withdrawn to the same distance and advanced again, a vacuum being maintained constantly and the point of the needle kept within the tumor. Tissue from the tumor mass enters the needle and is held within it both by the punch action of the advancing needle and by suction of the vacuum. Before the needle is completely withdrawn from the tissues, the piston must be slowly released, the syringe detached and the needle withdrawn separately. After the withdrawal of the needle, the syringe is partially filled with air and again attached, and the contents of the needle are slowly and carefully expelled on a glass slide. A second slide is then placed over the first and, with firm pressure, the contents are crushed very thin. Then the slides are drawn across each other lengthwise.

The specimen is then prepared by fixing the smear with heat and immersing in the following solutions: alcohol, one minute, water, one minute, hematoxylin, one minute, water, one minute. It is checked by microscope for cellular stain, and the process repeated if necessary. Then eosin, one minute, alcohol (95 per cent), one half minute, carbolxylene, one half minute, xylene, one half minute, are used and the specimen is mounted with Canadian balsam and cover glass.

It is advisable to have a Wassermann and a Kahn test in all cases. In dealing with cancer, the knowledge of the presence or an absence of syphilis as a causative factor or a complication is of such importance that, in the majority of clinics, blood tests are routine. A boy, aged 16, who came to my clinic some time ago had a large swelling of the left cheek. For nine months, he had been under treatment for different conditions in several of the better medical institutions. On examination of the neck, we found two large ulcers over the course of the sternocleidomastoid muscle. (One of the chiefs of staff made a statement a few years ago bearing on such cases as this one: "Gummas of the neck always occur over the course of the sternocleidomastoid muscle.") As there was no record of a blood test in the history, blood was drawn for a Wassermann and a Kahn test. The reaction proved to be positive, 4 plus. The age of the patient had misled the doctors for several months. He was given antisyphilitic treatment and the tumor of the cheek receded satisfactorily. Since then, a blood test is routine in a patient who is suffering from tumor any place in the body.

Cancer of the lip is chiefly a disease of men from 50 to 70 years of age, but it does occur in women and young adults. Among the thirty-five cases reported by Warren, four were in women and three of these were smokers. Of 1,338 cases collected by Fricke, 91 per cent were in men and four of the lesions were multiple. Many were clearly traceable to irritation from pipes and cigars. A child 4 years old was brought to the clinic at Memorial Hospital in New York with a cancer of the upper lip which was superimposed on a lesion of impetigo and was due to the almost continual scratching of the lesion by the child. The majority of cancers of the lip occur on the lower lip and laterad from the midline. Contact infection has been held responsible for

the appearance of a cancer on the upper lip opposite the lesion on the lower lip, but lymphatic connections offer an alternative explanation, since both blood and lymph vessels encircle the lips.

Two main forms of these lesions occur, papillary and ulcerative infiltrating types. The papillary form appears as a wartlike thickening that long remains elevated, at times with greatly elongated papillae. It extends slowly in all directions as a flat thickening within the epidermis and is slow to invade the deeper tissues of lymph nodes. Therefore, the underlying tissues remain soft. Later, it may ulcerate and follow the usual course of an infiltrating cancer. This type of cancer is of long duration and has a somewhat characteristic appearance. Since this type yields to conservative operation, it should be carefully distinguished from the more malignant forms.

The ulcerative type has an early infiltrating process which may be evidenced in a thickening of the epithelium or as a nodular growth invading the submucosa from the first and lying beneath rather than on the surface of the mucous membrane or skin. When it ulcerates, it produces a broad deep ulcer with pearly edges or a bulky excavation, which may then become fungated. These lesions are not infrequently associated with much inflammation, extending along the floor of the mouth to involve the periosteum of the mandible. Within a short time, they invade the lymph nodes of the mental, sublingual and submaxillary regions.

Cancer of the tongue is one of the most accessible tumors and may be recognized in its early stages. In spite of all that, it is one of the most malignant types of cancer, with a mortality of from 75 to 90 per cent. The microscopic structure of these tumors is rather uniform, but as their gross features and clinical courses vary considerably, a very detailed acquaintance with this disease is demanded of one who hopes to deal with them successfully. Failure to recognize early or precancer conditions, temporizing with small but fully developed lesions and extravagant sacrifice of tissue in mild cases are common errors, and are largely responsible for the ultimate mortality in these cases and for that dread of the disease which leads many to conceal its existence as long as possible.

This disease occurs chiefly in the fourth to sixth decade. Sigel observed a case in a boy 6 years of age. Piquet observed that 17 per cent occur in women. The important factors in the causation of buccal cancer are syphilis, the use of tobacco and the presence of defects of the teeth. Not infrequently, all three of these factors are present at the same time. I have seen three different types of cancer on one side of the tongue at the same time. The patient was syphilitic and an inveterate smoker and his mouth was very dirty. The action of syphilis is indirect. Cancer is usually superimposed on a long exisiting syphilitic lesion when the combination does occur. The pearly white thickening of the epithelium in leukoplakia is characteristic and so must always be regarded with suspicion.

Tobacco plays the most important rôle in the causation of cancer of the mouth. Its exact effect is not entirely understood, but its use is prone to produce a sort of inflammation which prepares the tissue for the development of cancer. Tobacco chewers often are victims of cancer in the area which is in contact with the quid. Tobacco cancers occur not only on the lips and side of the tongue, but also on the base of the tongue, tonsil, pharynx, palate and larynx. It seems evident that the thermal factor is hazardous.

An imperfect condition of the teeth is apparently directly responsible for many

cancers of the mouth. The most obvious cases are those in which a projecting or ragged tooth continually abrades the mucous membranes, especially of the tongue. It is often difficult to detect the exact source of the dental irritation and so it is frequently overlooked. Imperfect alinement of the teeth, a sharp although smooth edge, caries, especially of the roots, pyorrhea, a chronic alveolar abscess, or the traumatism of a troublesome extraction may be sufficient to initiate cancerous growth, especially in a syphilitic patient who is a smoker. Many other inflammatory lesions have been described as precancerous. Jacobson enumerates them as: (1) chronic glossitis with hypertrophy and fissures, (2) leukoplakia, especially of the fulminating type, (3) ichthyosis, or later stages of leukoplakia, (4) chronic atrophic glossitis, "bald tongue," (5) papillomas of various types, (6) fissures and (7) ulcers of any type.

The treatment of cancers of the mouth, as that for neoplasms of any other portion of the body, consists of preventive (or prophylactic) and active therapy. In the former, we must recognize the precancerous conditions and correct them before the true cancer develops. There are four recognized therapeutic means of treatment in cancer: (1) the surgical knife, (2) the surgical cautery, (3) radium and (4) the roentgen rays.

All of the effects of radium and the roentgen rays on the tissues are not understood, but the physics of radiation and many of the reactions of rays on living tissues have been sufficiently studied that they may be used with safety. Very satisfactory results are being obtained at the present time.

Time was when patients suffering with cancer submitted to operation, unless the condition was hopeless, and then irradiation was advised; but now we know that embryonic cells are readily destroyed by radium and roentgen rays, and that, as the cells become more mature, they are more resistant to the rays. In the foremost cancer institutions of the world, cancerous growths are grouped by biopsy into ray-sensitive and ray-resistant tumors. At Memorial Hospital, New York, Groups 1, 2, 3 and 4 are ray sensitive and 1, 2, 3 and 4 are ray resistant. Irradiation is, therefore, preferred to surgery in some cases, and vice versa. The Canti movie film showed how the rays tend to stop the movements of cancer cells and fix them in their place before true destruction takes place. Not infrequently, tumors are irradiated before surgical procedure and again almost immediately after the operation.

Another therapeutic means, and a most useful one, is the actual cautery knife, which is quite as valuable in its place as the surgery knife. It has become very popular within the last few years.

Permit me to differentiate between the cautery knife or loop and the old style cautery iron, which simulated the soldering iron. We seldom see the latter nowadays. Radium is an element extracted from uranium metal. The life of a gram of radium is approximately 2,500 years. That is to say, the molecules of radium will continue to be reduced in their atomic weight and explode to give off rays for a period of about 2,500 years. The alpha, beta and gamma rays are given off. The alpha rays are of little consequence to us. The beta rays are the caustic rays and the gamma rays destroy cancer cells, with but little effect on the normal tissue cells. By combining the beta and gamma rays, we may obtain as much caustic reaction as we desire, with the true effect of the gamma rays. Dosage of rays, both radium and roentgen, are determined according to the maturity of the cells and the size and depth of the

tumor. Of late, we have heard a great deal about the high voltage roentgen-ray machines, but according to Hayes Martin, of New York, experience has taught us that we must be more certain of the results to be obtained from a 200,000 volt machine, and until we learn more about the higher voltage, he recommends the continued use of the 200 kilovolt equipment.

If we can in some way gain the confidence of our patients so that they will report for examination as soon as these lesions start or, better still, teach them to accept treatment or frequent examination in precancerous conditions, and if our colleagues will make early and accurate diagnoses and employ therapy skilfully and without delay and follow this with frequent postoperative examinations, cancer of the mouth will be conquered, our patients will recover, and dentistry will have won a great battle for the human race.

SURGICAL SIGNIFICANCE OF THE PTERYGOMANDIBULAR FOSSA*

By HUGH W. MacMILLAN, D.D.S., M.D., F.A.C.D., Cincinnati, Ohio

THE increasing number of needles broken during the mandibular injection, the necessity for a more exacting technic in the injection of the mandibular nerve with alcohol in tic douloureux, the recovery of maxillary third molars forced upward and backward between the temporal tendon and the external pterygoid muscle and operative procedures on extensive cysts involving the entire ramus and condyloid process, as well as fractures and abscesses involving this region, call for a fuller description of the boundaries and relative position of the contents of the pterygomandibular fossa, a region which, with the complete acceptance of conductive anesthesia in dental practice, is rapidly becoming of greater surgical significance, being invaded several times daily by the hypodermic needle of almost every practicing dentist, at times with untoward results.

The pterygomandibular fossa may be described clinically as the region surrounding the point of the needle as it deposits the procaine solution during the mandibular nerve injection. It is bounded externally by the internal surface of the ramus of the mandible, the inner aspect of the masseter muscle and the temporal muscle with its tendon. Internally, it is limited by the internal pterygoid muscle, the lateral surface of the lower head of the external pterygoid muscle and the sphenomandibular ligament. Posteriorly, it extends to the condyloid process of the mandible and to the anterior border of the deep surface of the parotid gland. Its floor is the angle formed by the internal pterygoid muscle and the ramus. It is roofed by the inferior surface of the upper head of the external pterygoid muscle. Anteriorly, it is bounded by the plane of the buccinator muscle and the

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-Seventh Annual Session of the American Dental Association, New Orleans, La., Nov. 5, 1935.

zygomatic surface of the maxilla. The buccal pad of fat (corpus adiposum buccae) sends a prolongation to fill completely the boundaries of the pterygomandibular fossa, which is continuous with the fat lying between the temporal and masseter muscles and with the orbital fat through the inferior orbital fissure.[1]

The chief structures occupying the pterygomandibular fossa may be enumerated as follows: branches of the internal maxillary artery, the pterygoid plexus of veins, a small portion of the parotid gland, the extension of the buccal pad of fat, the long buccal nerve, the mandibular nerve, the lingual nerve and the deep facial lymph glands.

Fig. 1.—Reconstruction of muscles of mastication on skull of edentulous male subject approximately 65 years of age. This illustration will be useful in orienting the reconstructions depicted in Figures 3 and 4.

The alarming increase in the number of needles broken during the mandibular injection indicates that there should be an improvement in the teaching and practice of the technic of this injection. The first mistake is made in illustrating and demonstrating the technic of this injection on the dry mandible. If a mandible were used for the demonstration which had in place the temporal muscle or an accurate reconstruction of the temporal muscle, a glance would show that the internal oblique line of the mandible or the inner border of the ramus is not the strategic landmark to locate. In order to prevent catching the needle in the

Fig. 2.—Schematic drawing showing relations of principal structures of pterygomandibular fossa. The probe suggests a method of locating definitely the entrance to the pterygomandibular fossa through the interval between the temporal and internal pterygoid muscles.

1. Singer, Edward: Fasciae of Human Body and Their Relations to Organs They Envelop, Baltimore: Williams & Wilkins Company, 1935, pp. 11, 12.

fibers of the temporal muscle or its tendon, it is advisable to palpate with the examining index finger the inner border of the temporal muscle and to outline the space between the temporal muscle and the internal pterygoid muscle, as admirably described by Lindsay in the direct

Fig. 3.—Lateral boundaries of pterygomandibular fossa: temporal, internal pterygoid and lower head of external pterygoid muscles.

approach technic.[2] The point of the needle should be started, not along the inner border of the ramus, but midway between these muscles in the center of the depression produced by the pressure of the examining finger or by an instrument such as is shown in Figure 2. This will prevent catching the needle in the fibers of the temporal muscle, which invariably happens when the bone is closely followed by the needle. While the passage of the needle through the muscle does no particular harm *per se,* it is the direct cause of breakage, as a quick jerk

Fig. 4.—Location and extent of flap used to expose pterygomandibular fossa for removal of broken hypodermic needle from tendinous insertion of temporal muscle.

2. Lindsay, A. W.: Direct Approach Technique in Mandibular Block Anaesthesia, Faculty of Dentistry, University of Toronto, 1929.

of the patient or a slight bending pressure of the syringe will result in fracture of a small gage or weakened needle which is held in the tendinous tissue as in a vise.

The size and shape of the temporal muscle below the infratemporal crest and the extent of its attachment on the ramus is not generally appreciated. The temporal tendon extends from the coronoid process downward, covering the entire anterior border of the ramus of the mandible, joining with the fibers of the masseter muscle so intimately as to appear to form one muscle mass. In the preliminary palpation of this region for landmarks, the first point to be located is the anterior border of the masseter muscle, which is far anterior to the ramus. The next point to be located is the anterior border of the ramus; which calls to mind that the anterior border of the ramus is covered completely by the tendon of the temporal muscle, which takes its lowest origin from the bone just posterior to the lower third molar. The transverse diameter of the muscle in the plane of the injection depends on the development of the muscle and the extent of its contraction. A fair average for size is shown in Figure 2, which was drawn from photographs of actual cross-sections.[3] This muscle may be avoided so easily in making the mandibular injection that it seems there should be no excuse for breaking needles by catching them in its tendon.

Fig. 5.—Maxillary third molar lodged in pterygomandibular fossa after its accidental displacement during attempted extraction.

In making injections of alcohol in the mandibular nerve or, for that matter, in any other nerve, it is advisable to deposit the solution within the sheath of the nerve if possible. For that reason, a more exacting technic is necessary than that for the usual procaine injection. It will

Fig. 6.—Reconstruction of muscles of mastication, upper part of pharynx and inferior dental nerve; showing their relation to tooth accidentally driven into pterygomandibular fossa.

3. Eycleshymer, A. C., and Schoemaker, D. M.: A Cross Section Anatomy, New York City: D. Appleton Century Company, 1911.

be recalled that the mandibular nerve passing from the foramen ovale to the inferior dental foramen forms an angle of about 45 degrees with the ramus of the mandible. In the customary procaine injection, the point of the needle is directed to a point just above the lingula, infiltrating the mandibular nerve more or less successfully. To inject directly into the mandibular nerve, a plane should be chosen higher than that of the usual injection, in order to engage the nerve before it enters the foramen. The barrel of the syringe should be held over the region of the anterior teeth and the passage of the needle should be in a line parallel to the plane of the internal pterygoid muscle. Substituting this technic for that usually employed in the procaine injection has given universally better results, obtaining a quicker, a complete and a longer standing anesthesia.

Attempts at removal of needles broken during the mandibular injection have, at times, called for successive operations of three hours each and have sometimes resulted in failure to locate the needle. The fractured needle is usually found in the temporal muscle for reasons outlined in a previous paragraph. The exposure of the pterygomandibular fossa for operative procedures is illustrated in Figure 4. With the tissues stretched, an incision is made parallel to the inner border of the internal pterygoid muscle through the mucous membrane, the submucous tissues and the plane of the buccinator muscle. The lower point of the incision is carried externally to the external oblique line of the mandible and the upper point of the incision is extended laterally by cutting the tissues free from the tuberosity of the maxilla. The flap is reflected and held retracted against the mucous membrane of the cheek. In order to expose the structures most likely to contain the needle and to hold back the fat contained in the fossa, gauze is gently packed into the interval between the internal pterygoid and temporal muscles. The temporal muscle and tendon may then be explored for the needle. Under favorable conditions, the needle may be removed in as many minutes as hours have been consumed in less well-directed attempts.

The loss of an unerupted upper third molar in the pterygomandibular fossa during an attempted extraction is a regrettable incident. Since this tooth, from its position in the zygomatic surface of the maxilla, forms, in part, the anterior boundary of the fossa, its dislodgment and entrance into the fossa is always to be guarded against. The recovery of a tooth thus "lost" has been made by external incision through the cheek at the great risk, it might be, of facial paralysis and formation of a salivary fistula and an ugly scar. As in the recovery of the broken needle, the ideal approach to this region is through the opening made by the flap shown in Figure 4. With the aid of suitable long retractors and the judicious use of gauze sponges, the tooth is easily located and removed under local anesthesia.

Following operative procedures in the pterygomandibular fossa, the flap is replaced and the upper half sutured, a gauze drain protruding through the dependent part of the incision.

Another embarrassing complication which can be easily avoided is a hematoma due to the puncture of a blood vessel, probably the pterygoid plexus, by the hypodermic needle in making an injection of the posterior dental nerve. The simple expedient of making the posterior dental injection with the jaws tightly clenched automatically brings forth anatomic aids in preventing this complication. The contracted masseter acts as a guide for the puncture point of the

needle. The relaxed muscles of the buccal orifice allow the corner of the mouth to be retracted sufficiently far laterally and posteriorly to permit the needle to follow along the zygomatic surface of the maxilla instead of being carried into the interior of the pterygomandibular fossa, where are located numerous arteries and venous plexuses. The needle is usually inserted much deeper than is necessary. The attachment of the structures forming the buccal fornix is very high in this region. Insertion of the needle not more than half an inch beyond the upper attachment of the cheek opposite the second and third molars will effectively block the branches of the posterior dental nerve.

In extensive cysts involving the entire ramus; in fractures involving the ramus, coronoid process or condyloid process; in depressed fractures of the zygomatic arch; in infection of this region, an exact knowledge of the pterygomandibular fossa is of an inestimable importance.

Heretofore, the study of the pterygomandibular fossa has been made by the usual dissection methods, which, while commendable, leave much to be desired in gaining a surgical appreciation of this little known part of the body. Anatomic reconstructions made from actual dissections showing the relations of the muscles and principal structures are invaluable aids in gaining familiarity with the field. On reconstructions of vulcanite and metallic castings, such as are shown in the accompanying illustrations, operative technic may be planned in advance or clearly demonstrated in teaching.

The pterygomandibular fossa is a well-defined region which peculiarly belongs to dentistry. The muscles forming its boundaries motivate the mandible. The blood coursing through its arteries supplies the oral structures. The nerves passing through it are concerned more than any other with conductive anesthesia. The pterygoid plexus of veins, when punctured, furnishes one of the chief complications. In order to prevent and to correct untoward surgical complications involving this fossa, its anatomy should be clearly understood by every oral surgeon.

A COMPARATIVE STUDY IN ROOT RESORPTION IN PERMANENT TEETH*

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IT would be impossible to make even a close guess as to when men first observed the results of root absorption. No doubt, the loss of the deciduous teeth went on for years without number before men finally understood that at one time the temporary teeth had roots similar to those of the permanent teeth.

We are not so much interested in the chronology of the different steps in the natural loss of the deciduous teeth as observed by students. We have the facts now as related by scientific observers and, generally speaking, most people in the civilized world understand them. It is possible that facts yet to be discovered

*Read before the Section on Orthodontia at the Seventy-Seventh Annual Session of the American Dental Association, New Orleans, La., Nov. 6, 1935.

may change some of the theories of the present. Students of histology and anatomy are ever on the alert for new information. We know considerably less about root resorption in permanent teeth. In comparison, little actual scientific study of permanent root resorption has been carried on to date. Quite naturally, the advent of the roentgen rays has made it possible to make certain observations, but, strangely enough, few men have given a great deal of thought to the subject. At present, a scattered, limited number are interested enough to give of their best efforts to the observance and possible explanation of the phenomenon.

It is not the purpose of this paper to review the bibliography pertaining to the subject of root resorption, but rather to report some statistical findings of the work done at the School of Dentistry, University of Minnesota. In passing, it is a pleasure to compliment those men who have been, and who are, interested in the subject to the degree of having laid at least a partial foundation for further study.

Perhaps it would be well to attempt a word picture of root formation and root resorption. Some may have forgotten that, in a child of 10 years, the roots of a number of permanent teeth that are in place in the arch have not reached their maximum size. For instance, the average first bicuspid, which may be erupted at this age, may be, and usually is, about three-fourths the length it will be when fully matured. The growth of the root proceeds in such a manner as to make a crater-shaped opening where the pulp of the tooth enters. Peripheral growth continues toward the apex until the crater-shaped opening is closed with the exception of the foramen. Final development of the root proceeds on the pulpal wall until it is fully formed. In viewing a roentgen-ray picture of a root such as I have described, one would notice this crater-shaped opening at the unfinished end of the root. The size of the opening depends on the point of development at which the picture was taken.

Resorption takes place in a number of ways. The usual one, which is most easily noted, is that which seems to attack the root tip and travel toward the crown of the tooth, making what we have termed a "shed roof" effect to the root. The portion of the root nearest the pulp appears to be the last to give way. This process is exactly opposite to that of root formation.

Resorption of permanent roots may be the result of other stimuli than tooth movement by appliances. Not infrequently, loss of root structure is due to impaction pressures. When Richmond or other dowel crowns are used, resorption occurs frequently. Resorption in this type of case may be irregular and jagged, with no typical features such as are found in orthodontia. In my judgment, there are numerous other stimuli causing resorption than those mentioned. These are simply examples.

It became evident, by casual observation at first, in the orthodontia clinic at Minnesota University that the incidence of resorption of treated permanent tooth roots was frequent enough to warrant further study. We were only mildly interested, until it occurred to us that perhaps a comparison between persons who had had treatment and those who had had no treatment might be enlightening. Accordingly, a large number of full mouth roentgenograms were studied. All of the full mouth films taken in the diagnostic clinic over a given period, excluding only those which had a history of orthodontic treatment, were taken as a sample. These roentgenograms, representing all age groups from 7 to 70 years, numbered 4,560.

The incidence of resorption from all causes in this group is 12.6 per cent of the number of cases involved. We have tried to classify these affected teeth according to what might be the cause for resorption in each case. We realize the possibility of error in the procedure, since we have no histories to verify our judgment.

The data presented from the treated orthodontic group are gathered in the orthodontic undergraduate and postgraduate clinics of the School of Dentistry, University of Minnesota. The operating has been and is being carried on by the senior students under the direct supervision of instructors. The type of appliance used in most cases is the simple labial arch with bands made directly in the mouth and tied to the arch by wire ligatures. Bite-planes, both vulcanite removable and metal fixed, are used where indicated. Intermaxillary and intramaxillary forces by rubber bands are used as cases require them. Bite-blocks and splints are used infrequently.

Movement of the teeth is usually comparatively slow. Student work makes steady progress in movement difficult in comparison to results obtained by most experienced practitioners. Quite necessarily, with inexperienced operators such as the undergraduate student body, there would be a larger incidence of error in making adjustments in actual treatment even under supervision, and this fact may have some bearing on the percentages.

The number of orthodontic cases used in this study is 439. This number constitutes all the cases treated and under treatment for a given time in the teaching clinic. The large majority have been or are being treated by undergraduate students during the senior year. A few have been treated by postgraduate students of the same time period. In those treated by the latter, various types of appliances were employed, no one type predominating. The average age of patients treated by the postgraduate group was a trifle greater than that of the regular undergraduate clinic patients. The incidence of resorption in both groups is essentially the same.

In the following discussion, the orthodontic group will be understood to include all cases treated or under treatment for the designated time of this study.

Routine diagnosis of each of the orthodontic cases includes a full mouth roentgen-ray examination. For children in the clinic, a full mouth roentgen-ray examination calls for from twelve to fourteen films as the case may require. At one-year intervals during treatment, full mouth roentgenograms were taken of each case. The total number of beginning roentgen-ray examinations was 439. The total number of second roentgenograms, those taken at the end of the first year of treatment, was 439. The number at the second year of treatment was 277; the number at the third year of treatment, 121, and the number at the end of the fourth year, 34. No permanent root resorption was noted in the beginning roentgen-ray examination. At the end of the first year of treatment, 48.74 per cent of the total number were more or less affected. The third examination, which includes 277 cases, showed resorption in 74.63 per cent of these cases.

The age range of these patients was 7 to 21 years. The average age of patients at the beginning of treatment was approximately 10 years.

Division of the 439 patients shows 209 male and 230 female. Up to the time these data were tabulated, 135 cases show no resorption; 304 cases show resorption; 209 males show a percentage of resorption of 64.59; 230 females show a percentage of resorption of 73.47. The

combined group of 439 cases shows a percentage of resorption of 69.24. In explanation of the foregoing statement, of the 135 cases showing no resorption, some of these are finished and some are yet under treatment. Also, no attempt has been made as yet to estimate the degree of resorption in this series of cases. The percentages shown deal with the number of cases involved and not with the number of teeth.

The control group, or those studied who had no history of orthodontic treatment, ranged in age from 7 to 79 years. From 7 to 30 years inclusive, there are 1,609. From 31 to 55 years inclusive, there are 2,557. From 56 to 79 years inclusive, there are 394. In taking the age group of these comparable to the age group of the orthodontia patients studied, there are from 7 to 21 years of age, 739 cases. Thirty-eight of the 739 cases show resorption from some cause, a percentage of 5.14. All of these cases of resorption are found in the age group from 13 to 21 years inclusive. Twenty-three of these cases of resorption are to be found at the ages of 18 to 21 years inclusive. In the beginning, no one of the 439 orthodontia cases showed resorption of any permanent roots. Of the 739 cases with no orthodontic history, no patient 13 years of age or under showed resorption.

It is interesting to note the distribution of resorption in each of the groups studied. In the control group (those having no orthodontic treatment history), we find that the tooth least apt to be affected is the lower cuspid. The incidence of resorption in this tooth in the entire group is 0.55 per cent. The other teeth in order of their incidence of resorption are: lower lateral, lower central, upper cuspid, lower bicuspids, upper molars, lower molars, upper central incisors, upper lateral incisors and upper bicuspids. No definite explanation for this curious sequence can be offered. It is not known why the upper bicuspids are affected more often than the other teeth. It will probably take a great deal of study of anatomy and histology, as well as tooth analysis, along with study and experimentation in functional stresses throughout the mouth, to arrive at an acceptable explanation. Quite logically, the percentage of resorption runs highest between the ages of 25 and 45 years. In this interval, too, the largest number of erupted permanent teeth have been exposed to disease and treatment by restorative procedures. Between these ages, people appear to have the largest number of serious dental operations performed. It seems that, in many cases, resorption is directly attributable to the dental restoration in and on the teeth.

To return to the orthodontic group: The percentage of resorption runs as follows, beginning with the least affected tooth and naming the teeth in order: lower bicuspids, upper bicuspids, upper first molar, lower cuspid, lower first molar, upper cuspid, lower lateral incisor, lower central incisor, upper central incisor and upper lateral incisor. Resorption is most prevalent in the upper and lower anterior four teeth. These teeth suffer the greatest amount of root loss also. Although the curve of estimated tissue loss has not yet been worked out, it takes but little study to be convinced that the anterior four teeth, upper and lower, sustain the largest loss.

By far the largest number of cases of resorption occur in patients treated during and after the age of 11 years. The percentage of resorption increases rapidly from this age to the age limit of treatment in our clinic. Although the data available have not yet been tabulated, it seems apparent that gentle forces on teeth not fully formed have little effect on

their predestined size. In other words, the teeth not fully formed seem to keep on growing normally when treated during the naturally fast growth periods of the child, especially in the younger age limits of childhood. It is thought that some teeth may be stunted in length growth if treated vigorously during the later age limits of childhood. There is some evidence of this phenomenon.

Many questions arise in the study and analysis of these groups. I am attempting to prove only that resorption occurs more frequently in patients treated orthodontically than in those of the same age group who have had no orthodontic treatment. Both the groups studied are, as nearly as we can tell, in the same economic group and on the same health level. Our data are as yet meager in relation to the largeness of the problem. Years of study and compilation of many data are necessary.

One intriguing phase, of the many one might discuss, is the actual damage the resultant resorption really causes. No data bearing on this are available. So far, we can only guess. It is logical to conclude that a cuspid root foreshortened one-half will not carry a definite type of restoration as long as one not so affected, other conditions being equal. On the other hand, there is only a conjecture as to the amount of damage to the mouth and health of the patient that might have occurred had no orthodontic treatment been given. Those of us who have practiced general dentistry sufficiently long to gain a proper background of experience can recall and visualize many cases wherein the wrecking of the masticatory apparatus seemed due to malocclusion alone. It is possible that the foreshortening of a few roots, owing to orthodontic treatment, might not in these cases have been too large a price to pay for other advantages gained by treatment. This statement is not meant to condone the resultant resorption, for it must be our business to avoid such results in treatment. The question is, how?

The work at the University of Minnesota Clinic is reported for the reason that it is the beginning of a thorough questioning of methods of teaching and practice of orthodontia and not an indictment of the practice of orthodontia. We would be happy to consult with any individual or institution analyzing this problem who believes that a scientific analysis is desirable and necessary.

I shall mention just a few of the many angles of the problem that are being, or perhaps should be, studied. The correct age at which to have treatment is a broad field of study. Proper diet constitutes an intriguing field. The type of appliance and rapidity of movement need much study. The combination of forces to be applied at a given time might in itself keep an investigator busy for years.

No attempt to state these phases of the problem in the order of their importance is intended. A thorough study of the problem as a whole by a competent group is necessary in order that proper research can be carried out and the resorption of roots due to orthodontic treatment can be completely eliminated. It is not my belief that the phases mentioned are by any means all the angles of the subject to be studied. Some of these fields are being investigated now and every encouragement should be given the men and women who are devoting their time and energy to such service.

ENAMEL AND DENTIN METABOLISM ILLUSTRATED BY REACTIONS TO CARIES*

By THEODORE B. BEUST, D.D.S., Louisville, Ky.

MATTER, whether inanimate or animate, changes with time. Changes in inanimate matter are chemicophysical phenomena. In animate matter, the same forces are potent, with the difference that changes are directed by vital impulses. Directed changes stimulated by physiologic or pathologic processes are diagnostic of the living. Living organisms which rapidly pass through periods of youth, maturity and senility exhibit the greatest change. Supporting skeletal tissue offers ample evidence of changes with age. Of the dermal skeleton, the teeth, although offering great difficulties of demonstration and interpretation, are no exception.

The nature and rapidity of changes occurring in a part are determined by the quantity and quality of the elements conveyed to them. The meager demand of the more or less passive sclerosed structures may be satisfied with extravascular lymph spaces such as interprismatic spaces, bone canaliculi and tubules. If this supply is compared with the blood vascular flow to the soft structures actively engaged in the animal economy, the difference is simply one of degree.

A few decades ago, the apparent absence of channels of communication between the systemic circulatory system and the hard structures of erupted tooth crowns supported a belief that these tissues were inert, incapable of response and altogether segregated from the metabolic mechanism of the body. Were this contention true, all endeavors to modify tooth structure by dietary or physical means would necessarily prove futile.

Channels by which a posteruptive metabolism becomes possible have now been demonstrated[1] and changes in both the enamel and dentin which must be regarded as growth phenomena have been described; yet many dental students are being taught the ancient conceptions of nonvital enamel and unchangeableness of dentin, teachings which support the practice of disastrous "extension for prevention" methods on the immature teeth of patients under the age of maturity.

There appears to be no more instructive way of establishing proof of vitally directed changes in teeth than to present the reaction syndrome elicited during the early stages of advancing caries. These reactions, in view of their evident purpose, must be regarded as visible manifestations of directed protective measures.

Controversies concerning the question of enamel and dentin vitality had their beginning in the earliest days of modern

*From the Research Laboratory of the School of Dentistry, University of Louisville.

*Work supported in part by a grant from the Research Commission of the American Dental Association.

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-Seventh Annual Session of the American Dental Association, New Orleans, La., Nov. 6, 1935.

1. Beust, T. B.: Contribution to Study of Dental Caries, D. Cosmos 53:659 (June) 1912.

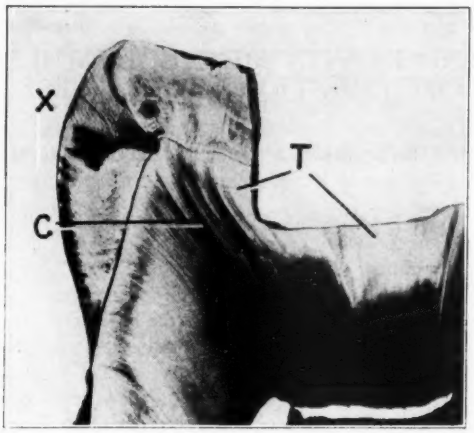

Fig. 1.—*T*, transparent zone; *C*, central zone; *X*, caries seen in Figure 7.

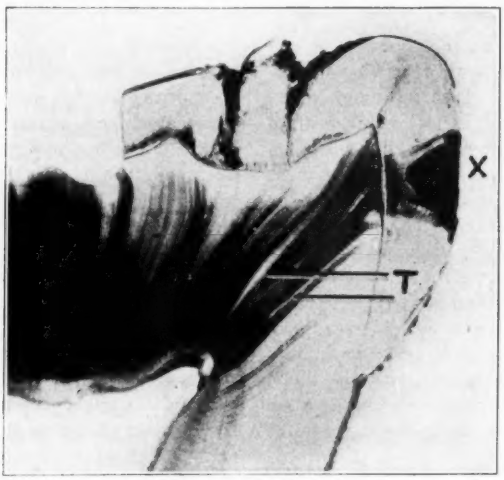

Fig. 2.—*T*, transparent zone; *X*, caries seen in Figure 9.

dental science. Sir John Tomes[2] (1850) was one of the first investigators to attribute changes in the dentin to vital forces. Tomes, at that time, claimed that the tubules irritated by caries became obliterated and the dentin rendered transparent by deposition of calcium in the lumen. This explanation of the transparency of dentin surrounding decay (Figs. 1*T* and 2 *T*) has persisted to the present day. Tomes' work had the

2. Tomes, John: A System of Dental Surgery (Phil. Tr. Roy. Soc.), Ed. 2, Philadelphia: Lindsay & Blakiston, 1872.

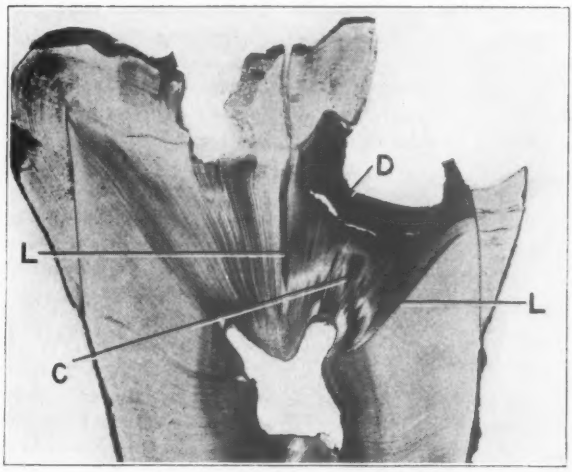

Fig. 3.—*L*, lateral opaque zone; *C*, central zone; *D*, decay (lysis).

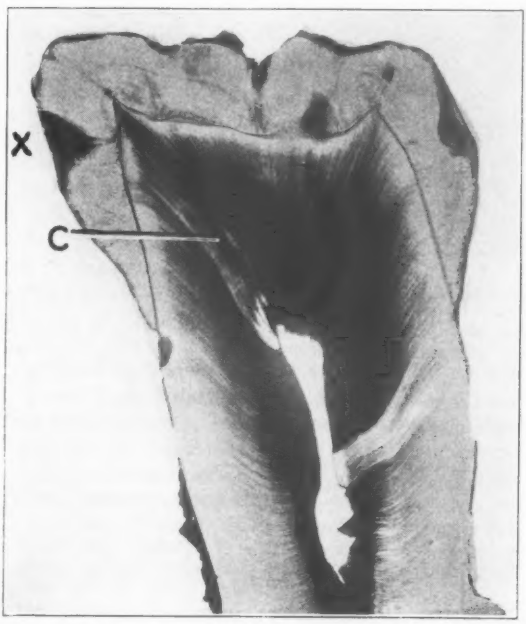

Fig. 4.—*C*, central zone; *X*, caries seen in Figure 10.

support of many early observers, notably Magitôt,[3] Neumann, Herz, W. D. Miller[4] and Walkoff,[5] but his findings were disputed by Leber and Rottenstein[6] and others, who claimed the transparency was caused by the presence of acids of decay.

Fig. 5.—Reflected light view of specimen shown in Figure 4. The area of opacity seen at the amelodentinal junction is sclerosed transparent dentin. (Compare with dentin in Figure 10.)

3. Magitôt: Traite de la carie dentaire, 1867.

4. Miller, W. D.: Question of Transparency of Dentin, D. Cosmos, 45:253 (April) 1903.

5. Walkoff: Mikroskop. Untersuchung des Dentins, Deutsche. Monat. f. Zahnheilk., 1885, 1892; Die Normale Histologie der Zahne, Leipzig, 1901.

6. Leber and Rottenstein: Untersuchung über die Karies der Zahne, Berlin: Hirschfeld, 1867.

These authors state clearly that the dentin between the decaying enamel enters into what they term the first or "preparatory" stage of dentin caries even before the surface continuity of the enamel has been disturbed. (Figs. 1*C*, 3*C*, 4C and 6*C*.) This observation attracted more attention in those early days than now. The inverted cone or central zone seen between the affected enamel and the pulp became the object of a controversy, which has not yet been universally settled. Tomes and his followers and, twenty years later, W. D. Miller regarded the changes in this central area as vital; while Leber and Rottenstein repeated their belief that a softening by acids had taken place. When we stop to consider that the last mentioned authors were the first to evolve the principles and most of the details of the chemicoparasitic theory of decay, their interpretation and attitude toward this problem are not surprising.

Three years ago, I made the reactions to caries the object of special study,[7] using methods earlier evolved in my experiments on the permeability of the dentinal tubules. With the aid of a protracted staining process, it was possible to demonstrate completely sclerosed, impermeable and chromophobic dentin (which is harder and more acid resistant than normal dentin) in the cone under caries. (Figs. 4*C* and 5.) This metamorphosed tissue is contrasted boldly with the normal unaffected dentin, which is chromophilic, revealing the quality of the tissue under and about areas of irritation, if viewed by reflected light. The normal and the sclerosed dentin are so accurately

7. Beust, T. B.: Reactions of Dentin to Advancing Caries, J.A.D.A., 20:631 (April) 1933; Inflammatory Zones in Dentin, J. D. Res., 13:399 (Oct.) 1933; Reactions of Dentinal Fibril to External Irritation, J.A.D.A., 18:1060 (June) 1931.

recorded by this method that the reaction tissue can be seen at a glance. (Figs. 5 and 11. Compare with the central zones of Figures 2 and 4.)

Before this method of staining and examination was made public, the changes in the cone were evaluated by transmitted light (substage illumination). Seen by substage light, the widely distributed chromophobic sclerosed opaque dentin, which is found almost without exception in the central cone, appears dark and infected (as seen in Figures 2 and 4). This has given rise to the popular view that the pulp is infected as soon as the enamel is penetrated, an inference that is refuted by these specimens, which display impermeable, unstained and practically solid masses of tissue between the caries and the pulp. These findings support the contentions of John Tomes and W. D. Miller and disprove the views of the opposing school, which regards the dentin as infected or soft or affected by fatty degeneration of its tubules.

Belief that the cone or central zone being discussed is a product of vital activity is sustained by the behavior of the zone which I prefer to call the "lateral opaque" zone, to better differentiate it from the central zone, which generally exhibits opacity. (Fig. 3*L* and Figures 1, 2 and 6.) This zone was pictured in 1867 by Leber and Rottenstein and was discussed by Miller in 1903. Miller was unable to decide whether the transparent dentin evolved from the opaque variety or vice versa. This question has apparently been solved by the methods here employed, which have disclosed that the lateral opaque zone, or at least that part of the zone which lies next to the normal dentin, is hyperchromophilic in active caries. This signifies that it is more chromophilic than is normal dentin. This chromophilia is extended to the dentin matrix substance, in which interglobular spaces and dentinoid enclosures (dappling), which in the surrounding unaffected matrix are calcified and chromo-

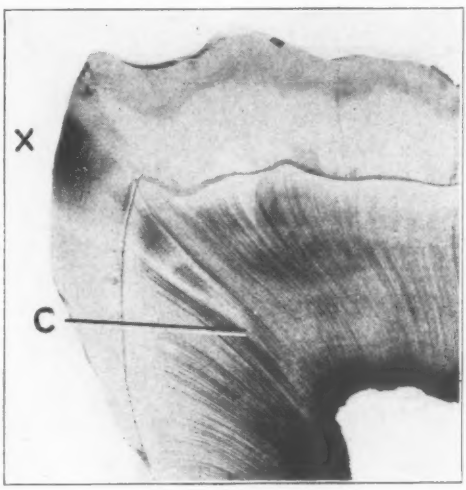

Fig. 6.—*C*, central zone; *X*, caries shown in Figure 8.

phobic, undergo a temporary lysis and become chromophilic. The zone is in fact an "inflammatory" zone.

The fact that is of significance to our subject is the absence of communication of the tubules of the lateral opaque zone and the carious lesion itself. They are separated by the impermeable transparent zone and are further segregated by the distribution of tubules, the central ends of which open into the pulp, while the peripheral ends end in sound enamel. Reactions which unmistakably occur in it must be reflected to it through the medium of the pulp. Further evidence of vital response is seen in the uniform relations of the lateral opaque zone to the decaying central area. As the central zone increases in width, the lateral opaque zone continues to retain its same relative position as regards this zone, the inflammatory reaction invading the normal dentin on the one side and leaving in its wake in its lateral wandering the transparent zone. This shows that the transparent zone is formed from the tubules of the lateral opaque zone. (Compare the journey of the lateral opaque zones in Figures 1-3.) This lateral wandering increases in vital teeth as long as the cavity enlarges. The hyperchromophilic part of the lateral opaque zone lies on the side next to the normal dentin. As the side nearing the transparent zone is approached, chromophobic fibrils appear, increasing in number until their aggregate forms ordinary opaque dentin,

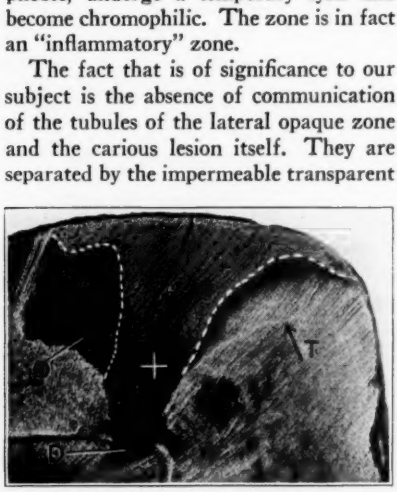

Fig. 7.—Enamel caries shown in Figure 1. *O*, chromophobic opaque enamel broken through at *X*; *T*, transparent fringe; *D*, decay (lysis).

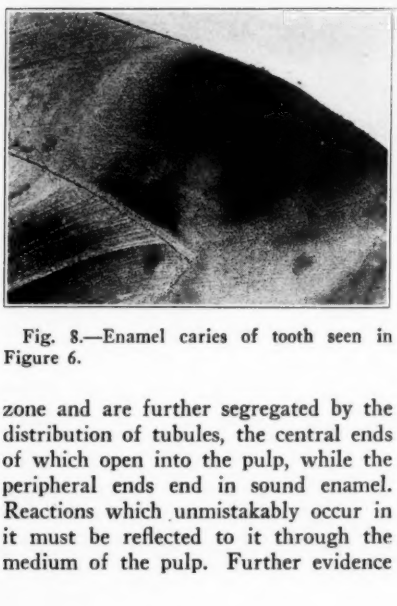

Fig. 8.—Enamel caries of tooth seen in Figure 6.

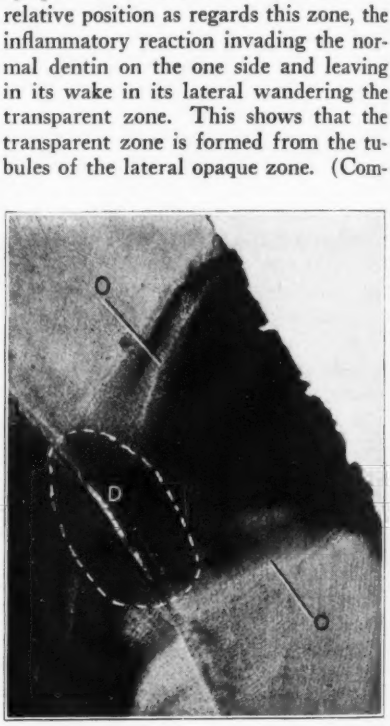

Fig. 9.—Enamel caries seen in tooth in Figure 2. *O*, opaque zones; *D*, decay (lysis).

which, in turn, is converted into the transparent variety.

Miller, who had no hesitancy in pronouncing the dentin "vital," was exceedingly cautious when the subject of enamel vitality was approached. Miller commented on transparent enamel surrounding caries of the enamel,[4] but, after a discussion, concludes that they are quite independent of the changes produced by caries. J. Howard Mummery[8] published a study of these zones in which, through the aid of an improved technic, unmistakable evidence of their association with enamel caries was shown. Of twenty cases examined, Mummery could demonstrate reactions in all but two.

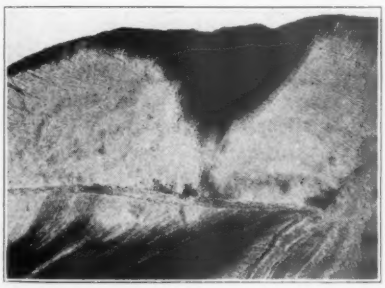

Fig. 10.—Enamel caries seen in Figures 4-5.

E. Applebaum presents interesting data on enamel caries.[9] He describes the optical reactions of a heavy opaque marginal zone bordering an area of caries. In type, this zone is analogous to one pictured by me in 1934.[10] This variety deviates from Mummery's zones, which are transparent, but they resemble these zones in that they are chromophobic, and hence nearly or quite colorless and, in contrast to the stained carious portion, appear, as observed by Dr. Applebaum, relatively white by reflected light. Chromophobic seams and islands which appear white are common in the stroma of decaying enamel and should prove significant in the evaluation of the acid theory of decay. Carious enamel lesions of considerable magnitude occur which are chromophobic throughout. This signifies that, when treated by my method,

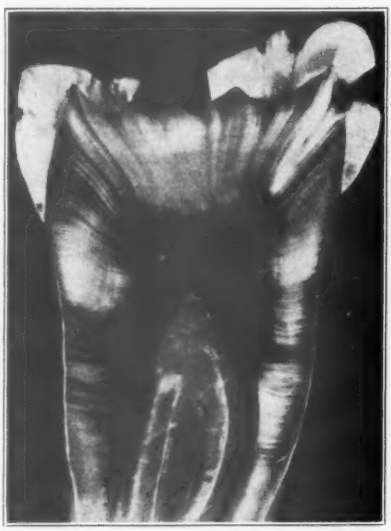

Fig. 11.—Reflected light view of specimen shown in Figures 2 and 9.

they are impermeable, resisting exposure to strong alcoholic fuchsin of at least one week's duration. This stain-resisting enamel is more often opaque than transparent. Combinations of the two are not uncommon and are often met with in resistance zones (Figs. 7-9). These share the property of appearing white by reflected light.

Where this chromophobic tissue stands

8. Mummery, J. H.: Translucent Zones in Enamel, Brit. D. J., 47:473 (May) 1926.

9. Applebaum, E.: Tissue Changes in Caries, D. Cosmos, 77:931 (Oct.) 1935.

10. Beust, T. B.: Dental Histology and Embryology, Philadelphia: W. B. Saunders Co., 1934, Fig. 74.

in relation to acid fastness of carious enamel may be inferred from decalcification experiments[11] which show that the apparently sound enamel in immediate contact with the caries frequently is the last of the unaffected enamel to be dissolved. This would conceivably correspond to the chromophobic zone.

The theory that the presence of the enamel zones is explained by a deposition of inorganic salts from the saliva (Head, Andresen) does not appear acceptable. The objection may be voiced that, in contact-point caries, which represents a high proportion of the lesions (perhaps over 90 per cent) in subjects that have not attained maturity, the decay develops in an area of stasis, which would preclude a physiologic action of the saliva. In deep fissure caries, the same objection holds. Furthermore, a deposition of inorganic elements during the time a cavity would ordinarily be exposed would occur only in enamel that previously had been decomposed; an assumption that would be inconsistent with the appearance of the tissue.

As I have earlier shown that the enamel tufts and spindles and interprismatic substance in newly erupted teeth contain colorable organic matter (proving a diffusion of fluids into the tissue) and that these calcify from within (become chromophobic) with age and that similar calcification processes can be proved to occur in the sclerosed zones of dentin caries and in normal dentin tubules, acceptance of the last named source of enamel sclerotization is indicated.

If we turn to the practical application of this knowledge, the question of diagnosis and prognosis in a case of early caries suggests itself. Practitioners have conceptions of rapid, slow, healed, dry (caries sicca), shallow and penetrating caries. The insignificant enamel "spots" (the unbroken ones) would scarcely excite attention during a dental examination, and it would be difficult to anticipate the rapidity of their development. A molar of an adult which is entirely free from them is rarely found. From the clinical point of view, many would regard such spots, in the case of adults, and very properly, as insufficiently developed for operative procedure. It is a fact that the specimens shown in Figures 4 and 6 exhibit no dissolution (lysis) and that those shown in Figures 7 and 9 display an insignificant amount, which may be encapsuled or rehardened. A lesion with chromophobic cones in the dentin may be said to be affected by caries, but this does not necessarily imply that the lesion is decayed. It may not yet have reached the lytic stage, or it may have healed.

Some may object to an application of the term metabolism to the transformations of substance here shown. That is a matter of opinion. I am convinced that the near future will provide us, in addition to the anabolic changes here shown, with reliable data on catabolism.

11. Beust, T. B.: Micro-Organisms and Caries, J.A.D.A., 17:1536 (Aug.) 1930.

CUMULATIVE RESEARCH*

By ARTHUR L. IRONS, D.D.S., Washington, D.C.

AUG. 3, 1859, more than seventy-six years ago, a group of twenty-six men met to form a national association of dentists. Prior to this time, in fact as early as 1834, independent societies had been formed for the scientific advancement of local groups of dentists. Some of the better known dental societies organized before 1859 were the St. Louis, Pittsburgh, Cincinnati, Western, Mississippi Valley, Pennsylvania and Indiana state dental associations, and the Ohio Dental College Association. The group which met on that momentous date in 1859 were representatives of these societies, with the addition of delegates from two dental colleges.

The object of this meeting was to form a national organization of dentists by means of which the interests of the dental profession could be better promoted. The association of dentists that resulted from this meeting has been a permanent organization, which has, through the past seventy-six years, contributed more to the advancement of dentistry than any other organization in the world. Dental education has grown from a short apprenticeship to a dental curriculum requiring years of intensive study. Read the list of graduates from one of our dental schools in 1888, twenty-nine years after the launching of this great forward movement in dentistry, and you will find students listed from Cuba, Canada, British Guinea, Brazil, England, France, Germany, Ireland, Nassau, N.P., Jamaica, W.I., New Brunswick and Russia. These men, regardless of nationality, came to our schools because dental education was on a higher plane here than in any other country in the world. Brief reports from three of our dental leaders who have only recently returned from a tour during which they investigated the dental conditions in Europe indicate that today we still have reason to feel proud of our accomplishments in the profession of dentistry, accomplishments that were made possible by centralization of effort and thought.

In 1895, the American Dental Association took another forward step in authorizing the formal adoption of the Army Medical Museum and Library as the National Museum and Library of the dental profession in the United States. This action centralizing the accumulation of dental museum specimens and dental literature was the result of the reading before the association of a paper, written by Williams Donnally, on "An Opportunity for a National Museum and Library." The object of this action was to collect and preserve dental material that would show the progress of dentistry and assist in obtaining knowledge in dental anatomy, histology, and pathology; and to collect and preserve all dental literature.

There are approximately 1,765 items in the permanent exhibit now on display in the dental section of the museum. This

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-Seventh Annual Session of the American Dental Association, New Orleans, La., Nov. 7, 1935.

material has been collected over a period of seventy-three years, during forty years of which this section has been sponsored by the American Dental Association. The items in this collection are instruments and appliances of historic interest, specimens of normal and comparative dental anatomy, orthodontia models, which were purchased from or donated by individuals and by the American Society of Orthodontists, and specimens showing pathologic lesions in the teeth, bones and soft tissues, the latter being shown in wet specimens and by means of wax moulages and plaster models. This section of the museum constitutes one of the finest sources for dental lay education in the country. Here, located in the nation's capital, which is a mecca for American tourists as well as for visitors from other nations, is a dental exhibit sponsored by the American Dental Association and visited by 80,000 or more people a year. True, we should have museums in other centers, but this is the logical place for a national dental museum. Here should be built the master exhibit of the history and progress of dentistry. Here, the outstanding exhibits prepared by the individual dentist or group of dentists should be placed, on either a temporary or a permanent basis. It behooves the American Dental Association as a matter of professional pride to present an exhibit that is representative of our professional advancements. We can add to and build up our exhibit as follows: (1) by donations from individuals or their estates; (2) by donations from institutions or commercial organizations; (3) by loans from institutions, individuals or estates, and (4) by purchase.

The dental museum is called on from time to time to prepare special exhibits for expositions and large dental meetings. We should be prepared, as a unit of the American Dental Association, to present an exhibit of which every member of the profession could be proud. This dental museum should be the nucleus of a group of similar museums with which we should be able to establish an exchange service of museum material, and thus assist in the building up of dental museums throughout the country.

The Army Medical Library, better known as the Surgeon General's Library, was selected in 1895 by the American Dental Association as the national library of the dental profession of the United States. The museum committee was instructed to cooperate with the library managers in enriching its stores of dental literature. At the present time, this library contains approximately 1,400 books on dental and allied subjects. There are approximately 1,900 bound volumes of dental journals, proceedings, transactions and congresses. The foregoing figures do not include annual announcements of colleges and hospitals or theses, pamphlets or directories, of which there are in the aggregate several thousand. In addition to the bound volumes on file in the library, there are forty-four separate dental publications received regularly by the reading room. The publications represent the dental literature of the entire world. At the end of each year, they are bound and placed in the permanent files of the library.

There are other dental libraries located in various sections of the United States, but this is our central collection of dental literature, sponsored by the Association for the past forty years and with no expense to our members. Undoubtedly, there are some who do not realize the vast store of dental literature from which they are privileged to draw, regardless of where they are located. All of the bound volumes, except the rare copies, are available for loan through the public, medical

and dental libraries and medical and dental institutions.

The human being grows by cycles or stages; that is, growth is more pronounced between certain ages, the intervening years being the quiescent or rest period of development. These cycles are repeated until full physical maturity is reached. Educators tell us that the mind of a child will develop in a similar fashion. There are periods in the child's life when it learns rapidly, and these periods are each followed by one in which the child is apparently at a mental standstill. These cycles are repeated until the full mental development is attained.

So it seems to be with the history of dentistry. There are periods when the profession has moved forward with great strides, and then there were years in which dentistry seemed to be more or less in a quiescent stage, at the end of which it would surge forward again. The activities of the museum committee in its relation to the progress of the American (and National) Dental Association seem also to be analogous to the physical and mental development of the human being. In reviewing the history of the Association since 1895, one finds periods of activity and of inactivity on the part of this committee. In 1933 the American Dental Association appointed another museum committee and assigned to it the task and obligation of organizing a registry of dental and oral pathology.

My first reaction, and probably the reaction of some of the committee members to the word "registry" as applied to dentistry, was to ask the question, What is a registry? After some investigation, I found that the meaning of the word registry as it is applied to the medical and dental profession is the act of recording or writing in a registry or a series of facts recorded. In speaking of a registry of dental pathology, we mean the collection, preservation and indexing of specimens and their complete histories; the latter to include all diagnostic data, the kind of treatment given and the results of that treatment. In cases of malignancy or unusual pathologic lesions, there are follow-up letters sent out annually over a period not to exceed five years, these letters being sent to the contributor.

The Army Medical Museum maintains contact with the museum committee and its parent organization through the dental member of the museum staff. James B. Mann, of the Army Dental Corps, was on duty in the museum during the time preparations were being made for the formation of a dental registry. It was most unfortunate that this efficient officer, owing to a law limiting the tour of duty of an army officer in the District of Columbia, was ordered to foreign service in November, 1933. The appointment of a new dental officer to the museum staff produced an unavoidable delay in the organization and functioning of the dental registry. One of the first acts of the committee, through its secretary, was to go through all of the accessioned material in the Army Medical Museum and accession to our registry files all material pertaining to the mouth. For instance, all cases of carcinoma of the lip, tongue, cheek or palate or cases of carcinoma which had origin in some other location but which had infiltrated or metastasized into the oral cavity were accessioned to our registry. The following is an extract from the annual report of the Museum Committee for this past year:

The Registry of Dental and Oral Pathology has in its files at the present time 375 cases which are divided as follows:

Carcinoma	130
Cysts	54
Fibromas	36
Papillomas	19

Sarcomas	10
Leukoplakia	10
Miscellaneous*	116
Total	375

All of the cases in our registry have been extracted from the files of the museum and do not represent new material donated to the registry. Most of this material has a history that is far from complete, and since some of it was received ten or more years ago, it is almost an impossibility to complete the majority of the case histories.

The purpose of a dental registry should be three-fold. The first natural thing to do is to assist the professional man in his routine work within the oral cavity. We can do this by assisting in or making the histopathologic diagnosis from the diseased tissue. The registry will divide the membership of the Association into two groups: one group having available the services of a pathologist and the other group not having available such a service. To the first group, we will offer our services through their local pathologists. If there is a pathologist who needs assistance in making a diagnosis, the registry is prepared to take this case and circulate it to a group of qualified consultants and give to the original pathologist the opinions of this group. For this service, the registry will keep for accession either the tissue material or one or more representative slides with a copy of the case history. As regards the group who do not have available the services of a pathologist, we will receive their material direct and make diagnoses either through the medium of the museum staff, or if need be, through a group of consultants. The diagnostic report will be mailed directly to the contributor. For this service, we will retain for the registry files the tissue material and the case history. If roentgenograms accompany the case, and they should, and their return is requested, we will be glad to make a copy of them and return the originals.

As an additional service to the professional man, the registry should prepare loan sets composed of lantern slides, these sets to be so prepared that they can easily be used by study groups or in the smaller society meetings. A large percentage of our professional men are located in communities where dental meetings are few and far between and where it is difficult, owing to the expense involved, to procure suitable speakers. It is to this group that the registry should be of great assistance in their postgraduate educational program as it pertains to dental and oral pathology.

The second purpose of the registry should be to assist in the education of the undergraduate in dental college. This can be accomplished in two ways: first, by assisting the pathologic departments of our schools in the preparation of histopathologic material, and, second, by making available to them the accumulated statistics from our files. Realizing that some of the thirty-nine dental schools are forced to operate on a small and fluctuating budget, the registry should plan to supply, at a very small charge, all necessary lantern and microscopic slides required by the several departments of pathology to complete the courses in dental pathology.

The third, and the most important, purpose of the registry should be to accumulate a large collection of material on dental and oral pathology. This can be accomplished much faster in a centralized national effort than by local organizations. A healthy functioning registry should move steadily. It was anticipated that, in the beginning, the material would be quite slow in coming into the registry.

*Lesions having less than ten cases on file are grouped as miscellaneous.

Once started, and under the leadership of a capable and interested committee, the growth should be steady. This will assure an accumulation of material from which in collaboration with other similar collections, the dental profession of the future will obtain a better understanding of dental and oral pathology.

The natural question to expect, from the foregoing, would be: Is the establishment of this type of enterprise by the American Dental Association feasible and practical? My answer to that question is that the Army Medical Museum has in its files at the present time 7,990 cases accessioned under its five different registries. Probably, the outstanding registry, judging from the number of cases accessioned and the amount of active research pertaining to its registered material, is the Registry of Ophthalmology sponsored by the American Academy of Ophthalmology and Otolaryngology. This registry has, in the last thirteen years, accumulated 5,207 cases under intra-ocular pathology. From its files, there have been several articles published bearing on the pathology of the eye, and, from the cooperative research between the museum staff and the members of the Academy, much has been accomplished in the study of tumors of the eye, relative to the early diagnosis, treatment and a more certain prognosis. The success of this registry is due, first, to a committee active in the planning and the directing of the affairs of the registry; and, secondly, to the fact that it is sponsored by a group of professional men with similar interests.

A new registry being organized this year in the museum will be known as the Registry of Otolaryngologic Pathology. This registry is also sponsored by the American Academy of Ophthalmology and Otolaryngology. The otolaryngologists will contribute tissue from the ear, nose and throat. The throat, to the otolaryngologist, begins with the lips instead of the anterior pillar of the fauces. With the two groups invited to contribute similar material to a central accumulating point, there should result an extremely large collection of specimens coming under oral pathology.

For the dental registry to progress and fulfil its mission as an aid to the advancement of the dental profession, we must change the present arrangement. In the first place, the registry needs to be linked closely to and sponsored by two sections of the American Dental Association, rather than to be sponsored by the entire Association. These two sections should be the section on oral surgery and the research section. In the second place, we should have on our committee men who are interested in dentistry as it pertains to the average professional man, and to the possibilities of improvement in dental educational facilities. Some of the members on the registry committee should be leaders in the field of dental pathology and men who are vitally interested in the accumulation of a large collection of dental pathologic material as a means of adding to our knowledge of dental pathology and its sister science, preventive dentistry. The American Dental Association has been officially associated with the Army Medical Museum for the past forty years, twenty-seven years longer than any other organization, yet our registry is the only one located in the museum that is not functioning. It behooves us, as a matter of pride in our professional accomplishments and as a group of professional men jointly responsible for the health of the human being, to build up a national museum exhibit comparable to our world leadership in the field of dentistry, and actively to support our registry of dental and oral pathology that we may carry our part of the burden in the field of research.

RELATION OF RICKETS AND VITAMIN D TO THE INCIDENCE OF DENTAL CARIES, ENAMEL HYPOPLASIA AND MALOCCLUSION IN CHILDREN*

By DAVID H. SHELLING, M.D., and GEORGE M. ANDERSON, D.D.S.,
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THE problem of the relation of diet and vitamins to dental decay has attracted much attention in the last few decades. With increasing knowledge in this field of nutrition, especially as pertains to calcium and phosphorus metabolism and to vitamins, numerous papers have appeared in support of the thesis that dental caries is caused by a paucity of either calcium or phosphorus, or of one or more of the vitamins. The results of experiments in lower animals have often been applied *in toto* to the problem of dental caries in human beings; and calcium, vitamins A, D, and C and phosphorus have had their fashions in dental therapeutics. While it is unquestionably true that for ossification to proceed normally, an abundance of lime salt and of vitamins is required, experimental evidence that a paucity of calcium, phosphorus or of the vitamins mentioned is the primary factor in the causation of dental caries is not conclusive.

With respect to the occurrence of dental caries in rats fed deficient diets, the experiments of Hoppert, Webber and Caniff[1] and of Shelling and Asher[2] clearly indicate that the dental decay so obtained can be attributed to the coarseness of the ground corn used in the diets rather than to a deficiency in lime salts or in vitamins. The problem of dental caries in human beings is even more complicated, since complete dietary control from infancy to adult life is hardly possible, except in a very limited number of instances. The deficiencies which are likely to cause dental decay are those already mentioned, namely, calcium, phosphorus and vitamins C and D. Accordingly, many clinical studies are now concerned with the effect of providing adequate amounts of these substances in the dietary with a view to preventing or arresting dental caries. There have been fewer studies concerned with the effect of preexistent rickets, or of the provision of vitamin D in early infancy and childhood, on the incidence of dental caries. The most noteworthy investigations in this direction are those of Eliot and her

*From the Harriet Lane Home of the Johns Hopkins Hospital, Department of Pediatrics, the Johns Hopkins University, and the Dental Department of the Johns Hopkins Hospital.

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-Seventh Annual Session of the American Dental Association, New Orleans, Nov. 7, 1935.

*Aided by a grant from the Research Commission of the American Dental Association and by funds for dental research contributed to the Johns Hopkins Hospital Dental Staff by Miss Etta Cone, of Baltimore, in memory of her sister, Dr. Claribel Cone.

1. Hoppert, C. A.; Webber, P. H., and Caniff, T. L.: Science, 74:77, 1931; J. D. Res., 12:161 (Feb.) 1932.

2. Shelling, D. H., and Asher, D. E.: J. D. Res., 13:363 (Oct.) 1933.

associates,[3] in New Haven, and of the late Alfred Hess and his colleagues,[4] in New York City.

The method of study used in the present investigation is in general similar to that of the above-named investigators, except that children with deciduous teeth were also included.

The material for the dental study was obtained from our clinic for the study of the effects of viosterol in the prevention and treatment of rickets. The subjects were divided into two groups. The first group (A) was comprised of 126 children demonstrated to have had active rickets by roentgen-ray examination of the bones and by chemical examination of the blood for calcium and inorganic phosphorus, and who were treated with vitamin D until the rachitic process in the bones entirely disappeared. The age, sex and race distribution in this group are shown in Table 1.

The second group (B) consisted of 150 children who had received adequate amounts of vitamin D, in the form of viosterol in oil, in early childhood, and the roentgen-ray films of whose bones showed that they were completely protected against rickets. The average age of this group was 49 months, the oldest child being 7 years and 8 months. Of the entire group, twenty-eight were negro males; fourteen, negro females; sixty, white males, and forty-eight, white females (Table 1).

The lack of balance between negroes and whites in the two groups is to be expected, since the incidence of rickets in

TABLE 1.—AGE, SEX AND RACE DISTRIBUTION IN GROUP A (RACHITIC) AND GROUP B (NONRACHITIC)

Group	Total	Age Under 6 Years	Age Over 6 Years	Colored	White	Males	Females
A	126	84	42	119	7	68	58
B	150	123	27	42	108	88	62

TABLE 2.—INCIDENCE OF CARIES AND STATE OF ORAL HYGIENE IN THE TWO GROUPS

Group	Total	Number with Caries	Per Cent with Caries	Total Caries	Highest Number per Child	Average per Child	Hygiene: Clean Number	Clean Per Cent	Dirty Number	Dirty Per Cent	Fair Number	Fair Per Cent
A	126	68*	54	385*	13**	5	55	44	21	17	44	36
B	150	89	58	667*	20**	7.5	80	53	24	16	46	30

*Each tooth surface was considered as a source of a single cavity; a cavity on the mesial, occlusal, and distal surfaces of a tooth would therefore be three cavities.
**Each of these mouths was hygienically "dirty."

3. Eliot, M. M.; Souther, S. P.; Anderson, B. G., and Arnim, S. S.; Am. J. Dis. Child., 48:713 (Oct.) 1934.

4. Hess, A. F., and Abramson, H.: D. Cosmos, 73:849 (Sept.) 1931.

the former is about twenty times as great as in the latter, and hence the paucity of white subjects in group A.

Group A was examined during the winter and spring of 1934, and group B during the winter and spring of 1935. In addition to previous medical care, each child was examined physically on the day of the dental examination for evidence of residual rickets. The dental examination included a search for caries, enamel hypoplasia and malocclusion. For caries, a mouth mirror and explorer was used, supplemented by roentgenographic examination. For the diagnosis of enamel hypoplasia, visual inspection was relied on almost entirely, though, in some instances, when there was some indication that unerupted teeth (first permanent molars) would be extremely deficient in enamel covering, the roentgenogram was used as an aid in the diagnosis. For the demonstration of malocclusion, compound impressions and plaster casts were employed; and these were likewise supplemented by roentgenographic examinations of the mandibles and maxillae.

RESULTS

Caries.—The results of the examination for dental caries in the two groups are shown in Tables 2 and 3. From these tables, it is seen that the incidence of caries, with respect to percentage of cases, total caries and number of carious areas per child, was as great in the group that received vitamin D as in the group known to have had rickets in early infancy and childhood. The percentage of poor oral hygiene apparently bears no relation to the greater incidence of dental caries in one group than in another, since the oral hygiene was actually worse in the less susceptible group (52 per cent in group A as against 47 per cent in group B). For instance, of the twenty mouths showing the greatest number of carious areas, five were clean, ten were fairly clean and but five were dirty.

Enamel Hypoplasia.—Of the 126 children examined in group A, fifty-five, or 43 per cent, presented evidence of either "slight" or "marked" hypoplasia of the deciduous teeth. Twenty-eight showed "marked" and twenty-seven

TABLE 3.—DISTRIBUTION OF CARIES ACCORDING TO TEETH AND SURFACES INVOLVED

Group	Total Cases	Average Age Months	Teeth Involved	Number Involved	Surfaces							
					Occlusal		Mesial		Distal		Buccal	
					Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
A	126	65	Deciduous	346*	192	55.4	73	21.1	70	20.4	8	2.3
			Permanent	39	35	89.7	4	10.0	.....	.....	.....	.....
B	150	48	Deciduous	648†	282	43.0	165	24.0	189	29.0	12	0.2
			Permanent	19	14	2.0	1	0.5	.....	.....	.....	.....

*150, or 44 per cent, in second deciduous molars.
116, or 33 per cent, in first deciduous molars.
179, or 52 per cent, in lower deciduous teeth.
167, or 48 per cent, in upper deciduous teeth.

†294, or 45 per cent, in second deciduous molars.
184, or 29 per cent, in first deciduous molars.
370, or 57 per cent, in lower deciduous teeth.
278, or 43 per cent, in upper deciduous teeth.

"slight" hypoplasia. In addition, thirty-two gave evidence, on roentgenographic examination, that hypoplasia existed in the permanent teeth, but it was impossible to judge the degree of involvement. Eighty-seven children, or 69 per cent of the group, therefore, presented evidence of hypoplasia of the enamel of either the deciduous or the permanent teeth, or both. Nine hundred and forty-two teeth out of a possible 3,024, or 31 per cent, were affected in varying degrees, 294, or 9.5 per cent, being permanent teeth and 648, or 21.5 per cent, deciduous teeth. Fifteen children were found to have all twenty of the deciduous teeth hypoplastic in varying degrees; while thirteen others had at least twelve of the full complement of twenty deciduous teeth so affected (Table 4).

The study of enamel hypoplasia in group B was concerned with the examination of the coronal surfaces of the deciduous teeth, since the average age in this group of patients was a little more than 4 years, and hence only in very few had any permanent teeth erupted. The roentgenographic examination, while helpful in determining hypoplasia in the permanent teeth, is not entirely trustworthy, especially as regards the degree of involvement.

Only sixteen patients, or approximately 10 per cent, were found to have hypoplastic permanent teeth, these all being first molars. Twenty-six, or 18 per cent, had hypoplastic deciduous teeth. Only three, or 2 per cent of the 150 children examined, were classified as showing "marked" and thirty-nine, or 26 per cent, as showing "slight" hypoplasia; a total of forty-two, or 28 per cent. When individual teeth were considered, 223 deciduous molars of a possible 1,200, or 19 per cent, were found to be affected in a greater or less degree (Table 4).

Malocclusion.—In group A, seventy-seven cases, or 61 per cent, were diag-

TABLE 4.—DISTRIBUTION OF ENAMEL HYPOPLASIA IN THE TWO GROUPS

Group	Total	Number and Percentage with Evident Enamel Hypoplasia				Degree of Hypoplasia			
		Deciduous		Permanent		Marked		Slight	
		Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
A	126	55	43	32	25	28	50	27	50
B	150	26	18	16	10	3	2	39	26

TABLE 5.—DISTRIBUTION OF MALOCCLUSION IN THE TWO GROUPS

Group	Total	Class I		Class II		Class III		Open Bite		Over-Bite		Protrusion		Protrusion from Habits	
		Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent		
A	126	77	61	6	4	4	3	40	31	6	4	29	24	18	62
B	150	41	27	27	17	None		10	7	17	11	37	24	15	40

nosed as Class I malocclusion (Angle classification), which involves the mesiodistal or anteroposterior relation of the mandibular to the maxillary arch, as shown by the mesiobuccal cusp of the maxillary first molar fitting into the buccal groove of the mandibular first molar. There was malocclusion of the individual teeth in the entire group regardless of the relation of the arches.

Six, or 4 per cent, presented Class II malocclusion, that is, the distal relation of the mandibular to the maxillary dental arch; and eleven, or 9 per cent, showed a Class III tendency, which is the mesial relation of the mandibular to the maxillary dental arch. Forty, or 31 per cent, possessed open bites; and six, or 4 per cent, possessed overbites. Twenty-nine, or 24 per cent of the number examined, had protrusion of the maxillary teeth; eighteen of which, or 62 per cent, were due to thumb sucking and other habits (Table 5).

In group B, sixty-eight, or 45 per cent, had malocclusion of one form or another in a greater or lesser degree. Forty-one, or 27 per cent of the number examined, showed Class I, and twenty-seven, or 18 per cent, presented Class II malocclusion. No Class III malocclusion was found in the entire group. A total of seventeen, or 11 per cent, had deep overbites, and ten, or 7 per cent, had open bites. Protrusive types of malocclusion were found in thirty-seven patients, or 24 per cent; and of these, fifteen, or 40 per cent, of the cases of protrusion, were due to bad habits (Table 5).

COMMENT

The results of this investigation reveal that rickets *per se,* or predisposition to the development of rickets, bears no direct relationship to the incidence of caries in the deciduous teeth of children; and that the administration of vitamin D to children in early infancy does not protect against the development of such caries, at least in the deciduous teeth. The lack of a preponderance of caries in the group demonstrated to have had active rickets is the more surprising, since the entire group was composed nearly entirely of colored children whose diets were much poorer with respect to lime salts and vitamins than those of the prophylactic group, containing 70 per cent white children. The possibility that the Negro race is less susceptible to the development of caries has long been suggested on casual clinical observations, but actual quantitative proof of such a racial characteristic is still lacking. Our own results strongly support this theory, although the number of subjects is too small to be able to draw definite conclusions.

Thus, in group B, the prophylactic group, only nineteen of forty-two colored children, or 45 per cent, showed caries, as compared with seventy of 108, or 64.8 per cent, among the white children. The total number of cavities in the two groups shows a similar disproportion of caries in the colored and the white children.

Thus, the nineteen colored children in group B presented eighty-two cavities, or 4.3 cavities per child; whereas, the 70 white children in the same group had 526 cavities, or 7.5 cavities per child. The preponderance of caries in the white children is equally evident when the children in the two groups, A and B, are analyzed according to race, but without regard to the preexistent rickets. Thus, of the 160 colored children, eighty-five, or 53.2 per cent, had caries; whereas, of the 116 white children, seventy-five, or 65.5 per cent, had caries. The total number of cavities in the 116 white children was 536, or four and six-tenths cavities per child in the entire group, or seven and one-tenth per child

in the group showing caries. The total number of cavities in the 160 colored children was 516, or three and three-tenths cavities per child in the entire group, or six cavities per child in the group showing caries.

Although, as already mentioned, the number of subjects is too small to permit of any conclusion as to the racial factor in the incidence of dental caries, or for one to postulate a similar racial susceptibility to dental caries in the permanent dentition, nevertheless, the figures tend to indicate that rickets, a disease so prevalent in the colored race, does not predispose the colored child to the development of caries even to the same extent as it occurs in white children. These figures also show that the conditions that prevent or predispose to rickets apparently play no dominant rôle in the genesis or prevention of dental decay in the deciduous teeth. Whether similar conditions operate in older children, with permanent teeth, remains to be seen when these children are reexamined at some future date.

It is interesting to note in this connection that evidence of a racial factor in the incidence of dental caries in the permanent dentition may also be surmised from the study of Eliot and her associates.[3] Although, from their figures, dental caries was found more often in children with a known history of rickets, the percentage of caries was greater in the white children than in the colored, the former group consisting of 313 and the latter of 138. Similarly, of their groups receiving cod liver oil, the white children showed a preponderance of dental decay. If their groups are analyzed without regard to the presence or absence of rickets, the lesser incidence in the colored groups is still evident. The relationship between rickets and caries in their cases seems to be more evident in the white than in the colored children, although the latter are more susceptible to rickets. This may be explained by the fact that many of the children in Eliot's white group were of Italian parentage. Children of Italian parentage are, apparently, more susceptible to rickets than children of other white races living in this climate. Had their white children been composed of racial groups other than Italian, the relationship between rickets and caries might not have been so evident.

What racial factor, if present, is responsible for the protection of colored children, the most susceptible to rickets, against the development of dental caries is difficult to ascertain. A study of larger groups of children and young adults might throw further light on this interesting problem and ultimately lead to a better understanding of the cause of dental caries.

The factor of oral hygiene is apparently also without significance as regards the incidence of dental caries, as may be seen from Table 2. Like the dietary habits, the oral hygiene habits of the poorer negroes of Baltimore are far inferior to those of the whites, yet the incidence of dental caries appears to be less in the colored than in the white children.

With respect to the incidence of enamel hypoplasia in the two groups, our results are in accord with those of other investigators.[4] Table 4 shows that enamel hypoplasia of both the deciduous and the permanent teeth is definitely related to preexistent rickets. Our data do not demonstrate a relationship between enamel hypoplasia and caries.

The incidence of malocclusion was greater in the rachitic group than in the prophylactic group. This, of course, is to be expected, since such deformities of the mandible and maxilla may conceivably be more apt to occur in bones that

are affected by rickets than in normal bones. This was especially true of Class I and less so of Class II malocclusion.

SUMMARY

1. Two hundred and seventy-six children were studied with respect to the incidence of dental caries, enamel hypoplasia, and malocclusion. One hundred and twenty-six had roentgenographic evidence of rickets in infancy and early childhood, and 150 had received vitamin D as a prophylactic measure against rickets and, in these, the presence of the disease was ruled out by serial roentgen-ray films. In the first group, forty-two were over 6 years of age, and, in the second group, only twenty-seven were over this age.

2. The incidence of dental caries in the rachitic group was not greater than in the group receiving vitamin D. The incidence was greater in the white than in the colored children regardless of the presence or absence of rickets during infancy. The lack of a preponderance of caries in the rachitic group may, therefore, have been due to the larger number of colored children in this group (93 per cent) as compared with 28 per cent in the nonrachitic group. The conditions that predispose white children to dental caries and protect colored children against it are not clear.

3. The findings do not prove that a relationship exists between rickets and dental caries or that vitamin D is protective against caries in the deciduous teeth.

4. Enamel hypoplasia was found more often in children with a history of preexistent rickets, but there was no definite relationship between hypoplasia and caries.

5. Malocclusion, especially of Class I (Angle), was more common in rachitic children than in the nonrachitic group.

OBSERVATIONS ON RELATIONSHIP OF LACTOBACILLUS ACIDOPHILUS TO DENTAL CARIES IN CHILDREN DURING EXPERIMENTAL FEEDING OF CANDY*

By PHILIP JAY, M.S., D.D.S.; FAITH P. HADLEY, D.P.H., and R. W. BUNTING, D.D.Sc., in cooperation with MARTHA KOEHNE, Ph.D., Ann Arbor, Mich.

PUBLICATIONS from this laboratory have from time to time stressed the importance of sugar as an etiologic factor in dental caries. In a carefully controlled study, Koehne, Bunting, and Morrell[1] reported a close correlation between increase in sugar in the diet, elevated *Lactobacillus acidophilus* counts and increased caries activity in children.

*Conducted under a grant by the Rackham Foundation.

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-Seventh Annual Session of the American Dental Association, New Orleans, La., Nov. 9, 1935.

1. Koehne, Martha; Bunting, R. W., and Morrell, Elise: Control of Dental Caries in Children, Am. J. Dis. Child., 48:6-29 (July) 1934.

Likewise, it was found by them that a lowered sugar intake paralleled a diminution of *L. acidophilus* and caries inactivity. Because of the exhaustive precautions taken in order to control this study properly, they found it necessary to limit their observations to a small number of children. Consequently, it became desirable to duplicate as closely as possible certain phases of this study on a more comprehensive number of children.

Excellent material for such a study was available in a children's home near Ann Arbor. We had been in contact with this institution since 1927, having examined these children at least once a year. At the first examination, all existing cavities and fillings were carefully recorded, their approximate size and location being indicated. Extension in size of cavities and the appearance of new ones were recorded in a manner that made it possible for us to determine with a high degree of accuracy the activity of dental caries in each individual case over a number of years.

In addition to the clinical examination, cultures were taken from the mouth and examined for *Lactobacillus acidophilus*. At first, these cultures were made from

TABLE 1.—ACTIVE CARIES ON HIGH CANDY DIET

	Case No.	Average L. Acidophilus Counts per Cubic Centimeter of Saliva		
		3 Week Period Before Candy Was Given	5 Months on Candy	3 Weeks Following Period Candy Was Given
Inactive to active	1	1,970	74,528	1,400
	2	11,740	148,316	14,700
	3	2,950	64,390	24,750
	4	8,652	428,013	177,000
	5	51,666	59,526	30,400
	6	10,442	7,686S	320
	7	18,511	61,878	10,370
	8	56,400	78,636	90,000
	9	83,787	166,400	29,370
	10	23,950	100,858	91,500
	11	31,866	239,580	40,500
	12	2,690	100,842	32,000
	13	†	5,776	5,000
	14	†	5,193	240
	15	†	9,027S	470
	16	†	2,184	22
	32	21S	13,073	†
	37*	1,300	1,520	700
	50*	†	50S	†
Continued activity	33	491	63,400	3,225
	38*	125,000	28,900	30,500
	34	7S	17,211	11,250
	35	262,050	329,091	717,000

S, sporadic. *Degree of caries activity doubtful. †Cultures negative for L. acidophilus.

tooth scrapings. Later, with the development of a satisfactory quantitative method by Faith Hadley,[2] it was possible to determine the approximate numbers of lactobacilli per cubic centimeter of saliva. In this way, we were able to amass a great deal of interesting information. First of all, we found that, although the children had the usual amount of caries on admission, they, as a rule, developed no new lesions, and the old ones, although unfilled, became no larger. From 75 to 80 per cent of the children had no new caries over a period of several years. Of the remainder, only 5 or 6 per cent had any appreciable amount of caries. Positive acidophilus cultures were comparatively rare. The organisms were either entirely absent or present in small num-

TABLE 2.—INACTIVE CARIES ON HIGH CANDY DIET

	Case No.	Average L. Acidophilus Counts per Cubic Centimeter of Saliva		
		3 Week Period Before Candy Was Given	5 Months on Candy	3 Weeks Following Period Candy Was Given
Continued inactive	17	†	3,277S	6,000S
	18	0	14,364	23,400
	19	†	11,586	900
	20	†	3,706	275
	21	†	2,192S	9,000
	22	27	84,415	3,800
	24	220,000	262,500	427,000
	25	1,331	4,670	125
	26	34	5,058	200
	27	15S	115,562	26,600
	28	71S	20,800	505
	29	5,650	33,035	85,100
	30	3,350	11,793	7,150
	40	†	54S	†
	42	†	634	182
	43	†	32S	†
	44	53S	1,789S	275
	45	1S	5S	1
	46	24	41S	†
	47	†	†	†
	48	†	†	†
	49	†	†	†
	51	†	†	†
	41	53	643S	†
	39	1,062S	†	†
Active to inactive	23	16	9,593	25,000
	31	24,866	122,546	47,650
	36	6,186	19,350	3,900

S, sporadic. †Cultures negative for L. acidophilus.

2. Hadley, Faith P.: Quantitative Method for Estimating Bacillus Acidophilus in Saliva, J. D. Res., 13:415 (Oct.) 1933.

bers. In some of the children, they appeared sporadically

Our findings in this institution are interesting, since the diet was not in accord with the principles usually stipulated for the prevention of dental caries. It is widely believed that a diet must be well fortified with calcium and phosphorus as well as the various accessory food factors in order to be protective. An authoritative analysis of this diet revealed that it was deficient in many respects. Calcium and the phosphates were lower than is usually advocated for growing children. Oleomargarine was substituted for butter and the amount of milk served was insufficient. Oranges were served only at Christmas time and tomato juice was available in only small quantities. Cod liver oil was given during the winter months to some of the children who were markedly underweight; but the administration of cod liver oil cannot be considered responsible for the clinical findings since the incidence of dental caries was the same in the children who did not receive it. The diet was low in calories and, despite the fact that the excessive use of cereal has been condemned as conducive to caries, over 45 per cent of the caloric intake was obtained from cereal, bread and potato. Certainly, in the light of contemporary pronouncements, this diet is far from orthodox for caries prevention.

The one characteristic that made this diet so adaptable to this particular investigation was the almost complete absence of sugar. Artificially sweetened foods were used on only rare and very special occasions. Sugar was never served at the table and candy was forbidden as a general policy. Here, then, was a group of apparently healthy children, many of whom were either underweight or undersized, living on an inadequate low vitamine and low sugar diet, but who, nevertheless, had a remarkably low level of dental caries activity. The question then arises: Would the addition of an abundance of candy to the diet increase the incidence of dental caries in these children? This we proceeded to determine in the following manner.

METHOD

The children were living in groups of twenty-five or thirty under the cottage system. Two of these groups were selected for experimentation, and to these fifty-one children, candy was fed, under supervision. It was intended that the remainder of the children, who did not receive candy, would constitute the controls, but certain difficulties were met with in this regard.

Investigators who have attempted human feeding experiments will at once recognize the difficulties involved in the attempt to confine the consumption of candy to a restricted group of children living in an institution. In order to facilitate the execution of the project, the selection of the experimental group was left to the discretion of the director of the institution. He selected two cottages the matrons of which would be most apt to distribute the candy intelligently. It so happened that many of these children left the institution daily to attend a public school, and it was interesting to note that the incidence of dental caries in these youngsters had in the past been higher than in the children who attended classes on the grounds. It would have been preferable to select more of the children who had been free from caries and *L. acidophilus* for a number of years, but unfortunately we had to proceed in the manner that was most compatible with the routine of the institution.

Previously, *L. acidophilus* counts had been run on the saliva of all of the children at monthly intervals as a matter of

routine. During the experiment, the frequency of the bacteriologic examinations was increased to one a week for the children who were to receive the candy. All of the children in the institution were examined at the beginning of the study. As most of them had been examined by us several times previously, a complete history of the caries occurrence in each child was available for comparison.

The candy, which consisted of chocolate creams, fudge and hard candies, was supplied in wholesale lots and was dispensed by the matrons twice a day. The children were not limited in choice or quantity. They were merely requested to record their daily intake in individual memorandum books, which they carried with them at all times.

Despite all reasonable precautions, an effective bootlegging system soon became established which provided the controls with an undetermined amount of candy. This situation was discovered when saliva specimens from the control group that had been regularly negative became positive for *L. acidophilus* with amazing frequency soon after the distribution of candy was begun among the experimental group. The data here presented are therefore confined to the fifty-one children who we know consumed an abundance of candy daily for five months. Their dental caries record for this period can be compared to the twelve-month period during which they received no candy.

All saliva specimens were taken before breakfast and the method described by Faith Hadley[2] was employed in determining the acidophilus count.

RESULTS

Table 1 lists nineteen patients who had shown no clinical signs of caries during the twelve months previous to the experimental period, but who developed active caries within five months on the high candy diet.

Two patients (33, 38) had active caries in both periods. Subjects 34 and 35 were not present in the institution during the preexperimental period, but both of them developed new carious lesions during the five-month candy period.

The cases are listed by number in the first column. The average acidophilus counts for the three-week preliminary period appear in the second column. In the third and fourth columns are listed the average acidophilus counts for the five-month candy period and a three-week postcandy period, respectively. The letter S following a number indicates that the positive acidophilus cultures were sporadic rather than continuous during that period.

Of the twenty-three cases listed in Table 1, twenty-one, or 91 per cent, showed an increase in the acidophilus content of the saliva for the period during which candy was available. The acidophilus count dropped off in twenty, or 86 per cent, of the children during the postcandy period.

It is also apparent from Table 1 that of the cultures from the twenty-three children who developed caries during the five-month candy period, twenty or 86 per cent, were consistently positive for *L. acidophilus* for that period and the remaining three cases were sporadically positive.

Table 2 gives data on twenty-five cases in which there was no caries activity in both the twelve months previous to the experimental period and during the five months while they were on the high candy diet. Of this number, twenty, or 80 per cent, showed increased counts during the candy period and 75 per cent showed a drop in the postcandy period.

Twelve of the twenty-five inactive cases, or 48 per cent, were consistently positive during the experimental period.

Thirty-two per cent were sporadically positive, and 20 per cent were negative.

Listed separately in Table 2 are three cases in which active caries was noted in the preexperimental period, but developed no new lesions during the candy period, despite increased counts.

SUMMARY AND CONCLUSIONS

A group of fifty-one children living in an institution were under observation for a period of seventeen months. During the first twelve months of this study, while on a low-sugar diet, seven, or 13 per cent, of the children showed clinical signs of active dental caries. The following five months, during which all of the children received an unrestricted amount of candy, twenty-three, or 44 per cent, of the group showed evidence of active caries, an increase of 31 per cent in the comparatively short period of five months. Eighty per cent of the children had increased acidophilus counts during the candy eating period.

Although, as stated above, it was found that the children in the original control group received some candy, it is perfectly obvious that their source of supply was limited and that some of them probably received none. Granted that this cannot be considered a control group, since we know that many of them did receive candy, it is still interesting to note that in this group of 128 children, there were increased acidophilus counts in only 26 per cent as compared to the 80 per cent in the candy group.

The bacteriologic findings in this study are very significant. The actual clinical findings are not so impressive owing to the shortness of the experimental period and also to the fact that we were without a satisfactory control group for that period. Nevertheless, the actual increase in the acidophilus content of the saliva is very striking. We have obtained considerable evidence in the past[3] that in from 85 to 90 per cent of the cases studied by us, an increase in acidophilus content was followed by active dental caries within a year. Within the short period of this experiment, an increase in acidophilus was followed by active caries in 44 per cent of the cases. It is reasonable to assume, therefore, that if the experimental period had been lengthened from the five-month period to a year, a greater increase in caries would have followed.

This study does not prove conclusively that the consumption of large amounts of candy will increase dental caries. It does point in that direction.

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3. Jay, Philip; Crowley, Mary; Hadley, Faith, and Bunting, R. W.: Bacteriologic and Immunologic Studies on Dental Caries, J.A.D.A., 20:2130-2148 (Dec.) 1933.

LABORATORY EVIDENCE OF THE ANTIBIOTIC RELATIONSHIP OF MOUTH INHABITING BACTERIA*

By DON CHALMERS LYONS, M.S., D.D.S., Ph.D., Jackson, Mich.

THERE is unquestioned evidence that mouth inhabiting bacteria play an important part in the production of dental caries. Bunting and Jay, Enright and Freisell and others have shown a relationship between *Lactobacillus acidophilus* and dental decay. Fish, Anderson and I have demonstrated the importance of acidogenic streptococcci and other bacteria as regards this problem. These results show more clearly than ever that local environment is of tremendous importance in the production or prevention of caries after the teeth have erupted.

It was suggested some time ago that bacterial relationships in the mouth, particularily when they are antibiotic or antagonistic, influence the resistance of the teeth to caries. This was demonstrated by a series of experiments on rats when it was shown that certain mixtures of acidogenic, putrefactive and proteolytic bacteria limit the amount of presumptive dental decay. The exact mechanism of this relationship is not known because at present knowledge of the physiologic and biochemical reactions of the oral flora is very limited; in fact, it is an almost untouched field of dental research, but one which may prove very fruitful in the future.

We have but little conception of the tremendous number of chemical reactions taking place in the bacterial life found in the mouth. They are governed by the fundamental laws of chemistry; that is, solution, dilution, combination, mass action, etc.

There are many references in bacterial literature to the antagonisms developed between bacteria. A typical example is that shown by Rogers[1] (1928), who demonstrated that strains of streptococci inhibited the growth of *Lactobacillus bulgaricus*. The inhibiting agent is unquestionably of chemical nature, for it is not destroyed by heat to 100 degrees, is diffusable through a colloidin membrane and is not removed by filtration.

The chemical factors entering into a consideration of the relation between dental caries and oral bacteria are, mainly, hydrogenation and dehydrogenation coupled with either oxido-reduction or hydrolysis, hydrolysis and decarboxylation, direct elimination of carbon dioxide, deamination with the production of a fatty acid, a combination of deamination and reduction with the formation of a hydrocarbon, reduction with the formation of formic acid, oxidation and deamination with formation of an alpha keto acid, and perhaps many others. The reactions between bacteria or their vital activity products are mainly of a protoplasmic nature, which is logically a function of chemical affinities of the catalyzers to certain atoms of the substrate,

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-Seventh Annual Session of the American Dental Association, New Orleans, La., Nov. 7, 1935.

1. Rogers, L. A.: J. Bacteriol., 16:321, 1922.

this loosening the bonds between the atoms. The relative affinity of the catalyzer for hydrogen and oxygen is important with relation to the product, the results being either of simple chemical nature or hastened by enzymes.

It is quite easy to demonstrate in the laboratory that the biochemical reactions of bacteria are such as to neutralize or reduce acid products. First, from the standpoint of mass action and objective viewpoint, the following experiment was performed with these results, *Lactobacillus acidophilus, Escherichi coli, Bacillus subtilis* and *Proteus vulgaris* being used in a litmus milk medium:

0.01 ml. broth colony *Lactobacillus acidophilus* plus 0.01 ml. *Escherichi coli* added to a litmus milk medium produced a firm acid curd and no gas.

0.01 ml. *Lactobacillus acidophilus* plus 0.02 ml. *Escherichi coli* caused a reduction of the medium.

0.01 ml. *Lactobacillus acidophilus* plus 0.033 ml. *Escherichi coli* caused reduction of the medium and carbon dioxide.

Greater amounts of *Lactobacillus acidophilus* with a constant amount of *Escherichi coli* did not change curd formation. Likewise amounts of *Escherichi coli* greater than 0.033 ml. to 0.01 ml. *Lactobacillus acidophilus* did not change the mass action.

0.01 ml. *Lactobacillus acidophilus* plus 0.01 ml. *Bacillus subtilis* produced a semifirm curd with a slight amount of reduction.

0.01 ml. *Lactobacillus acidophilus* plus 0.02 ml. *Bacillus subtilis* produced no further change.

0.01 ml. *Lactobacillus acidophilus* plus 0.03 ml. *Bacillus subtilis* produced no further change.

0.01 ml. *Lactobacillus acidophilus* plus 0.04 ml. *Bacillus subtilis* caused reduction and putrefaction.

0.01 ml. *Lactobacillus acidophilus* and 0.01 ml. *Proteus vulgaris* produced a soft curd and no gas, but caused reduction and putrefaction.

A greater amount of *Proteus vulgaris* gave the same objective reaction.

In each instance, the inoculated tube of the medium was incubated for forty-eight hours at 37 C. before examination, 24-hour broth cultures being used for inoculation.

What did these reactions show on chemical analysis, overlooking as far as possible the breakdown products of the medium, which can be considered as similar to the oral medium; namely, food débris? *Bacillus subtilis,* in its putrefying action, breaks down amino acids and urea to ammonium carbonate by hydrolysis, the first of the chemical actions previously mentioned.

$$(NH2)2\ CO+2H_2O=(NH_4)2CO_3$$

Proteus vulgaris, Escherichi coli, Bacillus subtilis and *Lactobacillus acidophilus* also produce these reactions:

1. Hydrolysis and decarboxylation take place in the medium to break down the acids produced and form ammonia and carbon dioxide,

$$R-\underset{NH_2}{\overset{H}{C}}-COOH+H_2O=R-\underset{H}{\overset{H}{C}}-H+NH_3+CO_3$$

2. The amino acids are also reduced to form formic acid,

$$R-\underset{NH_2}{\overset{H}{C}}-COOH+H_2=R-\underset{NH_2}{\overset{H}{C}}-H+HCOOH$$

3. The acid products, such as butyric, lactic, acetic, succinic, formic, oxalic and citric acid, are dissimulated by aerobic, facultative and anaerobic bacteria in various ways. Therefore, it may be assumed that the lactic acid is first broken down to proprionic acid, then pyruvic and then acetic.

$$\begin{array}{llll} CH_3 & CH_3 & CH_3 & \\ CHOH \rightarrow & CH_2 + H_2O \rightarrow & CO + 2H \rightarrow & CH_3 + CO_2 \\ COOH & COOH & COOH & COOH \end{array}$$

The acetic acid is then broken down to carbon dioxide and water, or, in the presence of salts such as one finds in the saliva, to carbon dioxide and calcium carbonate.

$$\begin{array}{l} CH_3 \rightarrow CH_4 + CO_2 \\ COOH \end{array}$$

$$2CH_3COOH + CaO \rightarrow (CH_3COO)2\ Ca + H_2O$$

$$(CH_3COO)2Ca + H_2O \rightarrow 2CH_4 + CO_2 + CaCO_3$$

One must make mention of the fact that such chemical actions, if taking place in the mouth, are probably accelerated by the presence of one or several of the numerous enzymes produced by bacteria.

SUMMARY

No attempt is made in this brief paper to present conclusions. Its purpose is to show the necessity for a more comprehensive study of the biochemistry of the oral bacteria. These test tube reactions suggest the necessity for more thorough understanding of the reactions taking place in the mouth which end in dental decay. We now know that when dental decay is found in the mouth, certain bacteria will also be found; perhaps there has been a change in the physical relationship of certain foods causing certain chemical reactions to take place, and, under specified conditions, it is possible to produce decay in the mouths of laboratory animals.

These are objective results which should be analyzed. The reactions of the oral bacteria in relationship to their environment must be studied from a chemical standpoint to reach the next step in the solution of this problem.

DEEP NECK INFECTION SECONDARY TO DENTAL DISEASE*

By ARTHUR M. ALDEN, A.M., M.D., F.A.C.S., St. Louis, Mo.

DEEP infection involving the fascial planes of the neck has ever been and will probably always be the major complication associated with dental disease in the lower jaw. To quote Mosher's classic description of neck infection:

Pus in the neck calls for the surgeon's best judgment, his best skill and often for all of his courage. Pus in the neck generally kills by oedema of the larynx or by the rupture of the abscess bursting its bounds and flooding the larynx and trachea. Such cases are soon over. There is, however, a more lingering type of infection in the neck. In this form of the disease there is a thrombosis of the internal jugular vein or one of its branches comparable in every way to a thrombosis of the lateral sinus which may occur following an ear infection. This latter condition is well known to the profession and surgeons are on the watch for it, but thrombosis of the jugular vein following infection in and about the neck is not so easily recognized. Many of these cases are classified in the death certificate as septicemia of unknown origin.

Years ago, my interest in this type of infection was stimulated by the high mortality in a group of such cases in a

*Read at the Seventeenth Annual Meeting of the American Society of Oral Surgeons and Exodontists, New Orleans, La., Nov. 2, 1935.

hospital where I was in attendance. A few weeks later, I had the privilege of seeing a necropsy on a patient that had died of an abscess of the neck that began as a dental lesion in the lower jaw. From the type and location of the abscess, it appeared that the patient could have been saved had there been proper drainage before he became moribund.

Since that time, I have had the opportunity of seeing many such cases and it is my firm belief that most of the fatalities from this type of infection are unnecessary.

Table 1.—Location of Infection

Twenty-Nine Cases	
Submaxillary,	9
Parapharyngeal,	7
Submaxillary and parapharyngeal,	5
Submaxillary and submental,	4
Submental,	3
Submaxillary and jugular,	1

Table 2.—Organism Shown by Culture and Smear

Spirochaeta vincenti,	9
Spirochaeta vincenti and streptococcus,	9
Spirochaeta vincenti and staphylococcus,	2
Spirochaeta vincenti, streptococcus, colon bacillus,	3
Streptococcus,	1
Streptococcus and staphylococcus,	2
No culture,	3

This paper is based upon twenty-nine consecutive cases of infection in the fascial planes of the neck, all secondary to dental disease. The patients were all hospitalized and studied both before and after operation. Although they were without exception seriously sick, there was not a death in the group and not a case of osteomyelitis, and no case required tracheotomy.

Dental infection in the lower jaw necessitating, as it frequently does, surgical intervention even in the acute stage of the disease is occasionally followed by involvement of the deeper structures of the neck. There are two forms of mechanism that may act toward the production of this condition: (1) a suppurative periostitis beginning at the site of the local lesion and spreading downward or backward along the side of the mandible, then breaking through into the deeper structures; or, and this occurs most frequently, (2) an infection beginning locally as a soft tissue cellulitis and carried from there to the contiguous and sometimes even distant structures by way of the local venous circulation or lymph channels.

Table 3.—Trismus

Location	No. Cases	Slight	Moderate	Complete	None
Submaxillary	9	–	4	3	2
Parapharyngeal	7	–	1	6	–
Submaxillary and parapharyngeal	5	2	1	2	–
Submaxillary and submental	4	–	–	–	4
Submental	3	–	–	–	3
Submental and jugular	1	–	–	–	1

The latter conception of the method involved in the spread of the disease explains the dissemination of infection from a local lesion around a tooth to the entire side of the neck within a few hours.

The opinion is current among many of the profession that surgical disturbance of a lesion in the mouth is necessary before an extension of the infection can take place into the deeper structures. This is by no means the case. True it is that undue trauma to soft tissues in exodontia or other dental procedures does predispose to dissemination of the infection, yet

the frequency with which the dental surgeon is called on to operate in the presence of disease and the relatively small number of infectious complications that occur speaks much for the perfection of technic of the average extractionist in America.

In nine of these twenty-nine cases, no operation whatsoever had been performed and the neck infection occurred merely as a direct extension of the dental involvement into the deeper tissues. Twenty cases were preceded by some form of dental surgical procedure.

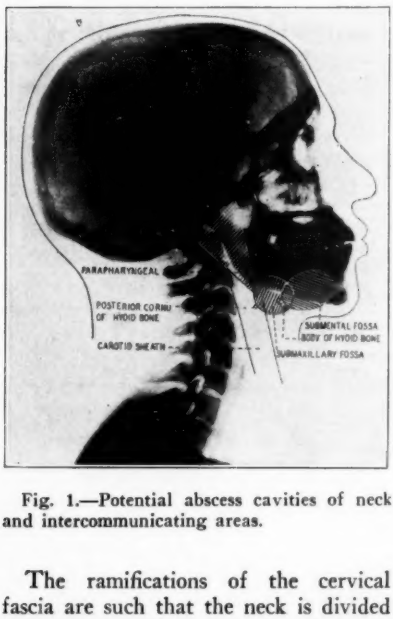

Fig. 1.—Potential abscess cavities of neck and intercommunicating areas.

The ramifications of the cervical fascia are such that the neck is divided into a series of planes and potential compartments. By the term "potential compartments," I mean certain spaces which, under normal circumstances, are not open, but which, when invaded by an abscess, become true compartments because of the limiting action of the various fascial planes and other structures on their several sides. The most important of these compartments for our purposes are the submental, the submaxillary, the parapharyngeal and the carotid. My conception of all of these spaces, with the possible exception of the submental, is that they are offshoots of the carotid sheath, which Mosher has termed "The Lincoln Highway of the Neck." By following it, we reach the base of the skull above and the chest below. Pus does the same thing. It may localize about the carotid sheath almost out of reach at the base of the skull. In the neck, it may collect along the sheath or in the sheath and follow it. It is the natural highway for pus and for the surgeon in pursuit of pus.

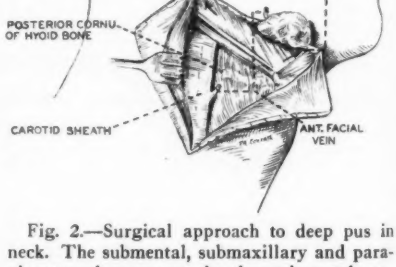

Fig. 2.—Surgical approach to deep pus in neck. The submental, submaxillary and parapharyngeal space may be thus adequately exposed and drained and the jugular vein inspected.

The submental fossa is a potential space lying underneath the tongue and above the level of the mylohyoid muscle. The anterior border of this space is the inner surface of the symphysis of the mandible, and infection spreading downward along the periosteum of the mandible naturally extends into this space. This type of abscess was described many years ago by Ludwig and today is still occasionally called Ludwig's angina. In the older publications, the mortality from

infection in this region was given as from 20 to 40 per cent. Today, in the light of our modern knowledge of such conditions, fatalities resulting from this type of abscess should be rare.

Just in front of the carotid sheath and connected with it by its posterior prolongation is the submaxillary fossa. This space lies just inside and below the mandible and in it rests the submaxillary gland, like an egg in the nest. Across and externally to the gland runs the fascial vein, and underneath the gland lies the fascial artery, the hypoglossal and superior laryngeal nerves. Just below and behind this gland is the most important and easily accessible surgical landmark on the lateral wall of the neck, the posterior cornu of the hyoid bone. As you will remember, this is a little horseshoe-shaped floating bone which is situated above the upper border of the thyroid cartilage and to which is tied practically all of the guy wires of the neck. Occasionally, in the presence of marked swelling, this bone cannot be palpated from the outside, but when any sizable opening is made in the lateral wall of the neck, its location can soon be determined by a gloved finger thrust through the incision.

Infection in this region more frequently occurs secondary to disease of the lower first or second molars.

The parapharyngeal or pharyngomaxillary fossa may be considered as a cone the base of which is attached to the base of the skull around the jugular foramen and the apex of which is at the tip of the hyoid bone. Below is the submaxillary fossa. The carotid sheath emerges from the apex of the cone and, for practical purposes, continues the fossa through the neck into the thorax. The inner border of the parapharyngeal space is the superior constrictor muscle with the tonsil attached to it. The bulge of the superior constrictor muscle and its attached tonsil into the throat in the presence of an abscess in this region is frequently mistaken for evidence of a peritonsillar infection. The outer border below is the internal pterygoid muscle lining the inner surface of the ascending ramus of the jaw and matching the masseter muscle on the outside. The outer border above is the parotid gland; the gland at this point not being covered with fascia. Abscess in this region is as a rule due to disease of the lower second or third molars.

Years ago, when we first encountered these neck infections, we were interested in the bacteriology of the disease and so studied carefully smears and cultures taken from the original lesion in the mouth and from the pus released at the time of operation. We were immediately struck by the fact that although there were usually several forms of bacteria present in the abscess, *Spirochaeta vincenti* was easily the predominating organism. In this group, it was found twenty-four times in twenty-six cases. The other two of them had no cultures. In nine cases, it appeared in pure culture; in nine cases, in symbiosis with a streptococcus; in two cases, with a staphylococcus; in two cases, with both the streptococcus and staphylococcus, and in two cases, with the streptococcus and the colon bacillus.

When it was recognized that this organism was probably the most important factor in the invasion by the disease of the deep structures of the neck, it seemed logical to combat the infection by means of neo-arsphenamine intravenously. All of our patients have received one or more doses of this drug. The results many times were almost spectacular. On several occasions, the rapid spread of a diffuse cellulitis of the neck has been stopped and localization has begun

within twenty-four hours after the administration of the drug. As a result of this experience, it has become a routine on our service to give all patients suffering from infection origin of which was in the mouth an intravenous dose of 0.4 gm. of neo-arsphenamine immediately after admission. This is done even though examination of smears from the original lesion in the mouth is inconclusive for Vincent's organism. I am of the opinion that this procedure is one of the most important contributing factors in the success of this group of cases.

Trismus is frequently an annoying accompaniment of these infections and is almost invariably the result of an irritative spasm of the internal pterygoid muscle on the affected side. This irritation is due to the presence of pus in the parapharyngeal space in direct contact with the muscle. This statement would suggest that trismus would occur very rarely in the true submental abscess case, and this was our experience. In this group, there were seven cases of abscess limited either to the submental region alone or to the submental and submaxillary regions. In none of these cases was trismus present. In every case in which the infection had invaded the parapharyngeal space, which, as you will recall, is limited in its downward and outward aspect by the internal pterygoid muscle, trismus was present. In ten cases, it was so marked as to make proper examination of either the original site of the lesion or the posterior pharyngeal wall impossible. In other words, to turn this fact around, we may say that, in such an infection, when trismus is present, its occurrence should make the surgeon aware that the parapharyngeal space has probably been encroached on.

There are several important secondary complications that may arise from deep infection in the neck: hemorrhage, osteomyelitis, general sepsis, edema of the larynx and pneumonia.

Hemorrhage, which, when it occurs, is, as a rule, postoperative, is usually due to erosion of one of the branches of the external maxillary artery. This occurred three times in our series and in one case was so severe as to endanger the life of the patient.

Osteomyelitis of the mandible has been a frequent complication in such conditions, and yet its entire absence in this group of cases, all of which were treated with neo-arsphenamine intravenously, would certainly suggest that these two facts are not entirely unrelated.

Sepsis following one of these abscesses is always due to an infective thrombophlebitis of the veins of the neck, usually the internal jugular or one of its branches. In the presence of an abscess in the neck, when the patient has a chill or repeated chills suggesting a shower of organisms turned loose in the blood stream, blood cultures should be taken and a careful inspection of the jugular vein and its branches carried out. Ligation of this vein can be, and frequently is, carried out without in any way endangering the welfare of the patient.

Edema of the larynx is a complication that arises quickly and, if not treated promptly by tracheotomy, ends the case in a few hours. In two of our earlier cases, the rapidly spreading cellulitis threatened to involve the larynx, and preparations for immediate tracheotomy were always at hand. The use of neo-arsphenamine greatly reduced the swelling and there were never actual indications for a tracheotomy.

Pneumonia is frequently a sequel to the spontaneous rupture of the abscess into the throat of a patient with trismus. Then, of course, the respiratory tract is flooded with virulent pus and pneumonia

is almost a certainty, if the patient is not immediately suffocated.

Our routine for such cases is unvaried. All of these patients are immediately hospitalized. Many of them reach us after several days of unsuccessful treatment and owing to the trismus or the swelling in the throat, which makes swallowing impossible, are greatly dehydrated. No attempt is made to give fluids or feedings by mouth, but a nasal feeding tube is immediately inserted and passed into the stomach and feedings of an excess of fluids and liquids begun at once. Neo-arsphenamine in a dose varying from 0.3 to 0.6 gm. is given intravenously, the dosage being based upon the age and weight of the patient. Moist heat over the site of the swelling, as a rule, contributes to the comfort of the patient, though I doubt seriously that this is an important factor in the localization of the infection.

The selection of the proper time for operation is an important detail. Earlier in our experience, we were prone to wait, if possible, until deep fluctuation could be felt in the soft tissues of the neck, but this delay was responsible for the near demise of two patients. Mosher makes the statement that to wait for fluctuation is to invite secondary complications, and I am entirely in accord with this point of view. I do believe that unless the indications for operation are extremely urgent, it is a good policy to wait, after the neo-arsphenamine has been given, for the period of maximum tissue saturation with the drug, which is about twenty-four hours. Operative procedure carried out at this time has to us seemed to have more rapid results and less secondary complications.

In all such cases operation should be performed under local anesthesia, because to use general narcosis on a patient whose airway is already mechanically embarrassed, or to eliminate or weaken with an opiate his coughing reflex, which is the sole guardian of the lower respiratory tract, is invariably fraught with great danger. Procaine infiltration, both superficial and deep, renders the operation painless and, at the same time, insures the operator of the full cooperation of the patient in what is, at best, frequently a difficult situation.

The type and location of the incision must depend entirely on the location of the pus. If it is clearly submental without involvement of the adjoining submaxillary fossa, a midline neck incision down to and through the mylohyoid muscle will satisfactorily drain such an accumulation. Occasionally, when the abscess is located immediately under the front of the tongue, it can be drained by an intra-oral incision. If the submaxillary fossa or the submaxillary and the parapharyngeal region have been invaded and exposure of this area is indicated, the Mosher-T-shaped incision exposing the submaxillary gland and then retracting it upward out of its fossa allows adequate exploration of the entire region. Through this exposure backward and upward, the gloved finger or artery clamp will enter the parapharyngeal space and posterior retraction will expose the vessel sheath containing the carotid and internal jugular vein. This incision in our hands has given the most satisfactory results. I do not believe in small incisions for exploration in the presence of a potentially fatal infection. Much better a live patient with a scar on his neck than a corpse with only a trivial cosmetic defect. In a few of our cases, it was possible to drain satisfactorily a superficial submaxillary abscess or an anterior parapharyngeal abscess by intra-oral incision, but by far the safer procedure in the majority of cases is the external approach.

After the abscess has been adequately opened and emptied, the cavity is packed lightly with strips of dental rubber an inch wide, and as long as is necessary in the given case. As the wound heals from the inside, this strip is gradually withdrawn and cut off at the dressings.

These patients are, as a rule, quite uncomfortable for the first few days of their postoperative convalescence and rarely are they able to take by mouth the amount of fluids necessary to keep their resistance at a high peak. To combat this state of affairs, feeding by means of a nasal tube is a most useful procedure and should be kept up until the patient can swallow without discomfort.

To eradicate a potentially fatal infection after it has developed is a very creditable achievement. By adequate treatment to prevent such an infection from ever becoming a serious potentiality is even more to be desired. We have, I believe, shown conclusively that *Spirochaeta vincenti* is the offending organism in by far the larger majority of these serious neck infections that follow dental disease in the lower jaw. Its recognition in the mouth before the damage has been done is a relatively simple task. Smears taken from the gingival margins or interdental spaces around the suspected tooth and easily stained will show the organism if it is present. Then, if surgical disturbance of the tooth is necessary in the presence of this infection, a preliminary dose of 0.4 gm. of neo-arsphenamine given twenty-four hours before the extraction or other procedure will greatly reduce the possibility of the disease spreading into the structures of the neck. This is not a theory, but a very practical safeguard that is being used by several exodontists today. I predict that, in a few years, the incidence of these neck complications following dental infections will be greatly reduced when this prophylactic treatment is carried out.

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CHEMISTRY OF SYNTHETIC RESINS

By JOHN S. SHELL, B.S., M.A., San Francisco, Calif.

SYNTHETIC resins, which have found such frequent and varied use in everyday life, offer an outstanding example of the practical results of scientific research. Their extensive use in dentistry is relatively recent. Celluloid materials as employed in dentures are not new, but they can hardly be compared with such products as the phenol-formaldehyde or vinyl resins. (Celluloid materials consisting of cellulose product dissolved in camphor have been used for dentures since 1871.)

From a chemical standpoint, the synthetic resins can be roughly classified as (1) condensation products and (2) polymerization products. The condensation products are the result of the interaction of two different substances to form a complicated organic compound, while the polymerized resins are produced by the interaction of molecules of one substance. In many cases, both types of reactions take place. The bakelite materials, which are phenol-formaldehyde resins, would be classed as condensation prod-

ucts; while the vinyl resins are probably formed primarily by polymerization.

A second classification based on the changes that take place during manipulation divides the resins into (1) thermosetting and (2) thermoplastic materials. In the thermosetting resins, a reaction takes place during the heating and pressing process. As this reaction is, in general, irreversible, after heating a permanent change in chemical composition has taken place. In the thermoplastic resins, no chemical reaction takes place during molding and the material is unchanged by repeated pressing. The phenol-formaldehyde resins belong to the thermosetting group and the vinyl resins to the thermoplastic group compounds.

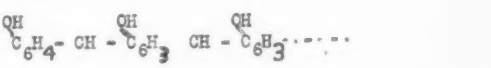
The chemical reactions that take place during the formation of resins are not fully understood, but the existence of long-chain molecules in the final product is generally conceded. The accompanying reactions and formulas may represent the type of molecules that are probably formed.

These chain compounds are formed slowly, at slightly above room temperature, but the rate of reaction increases rapidly when the material is heated. At high temperatures, shorter chains are produced, forming products which are not so resistant to solution or chemical attack as the longer chain resins. Some of the strongest, most resistant products are obtained by treating for long periods of time at low temperatures. The chains probably reach the length of 5,000Å by 3 to 10Å in the other dimensions in the normal resins. It is possible for the mole-

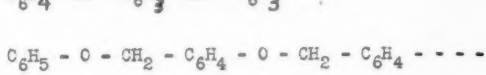
Phenol formaldehyde resins

Phenol . . . . . C_6H_5 -CH

Formaldehyde . . . . CH_2O

Condensed resin. . . 

or



Vinyl resins

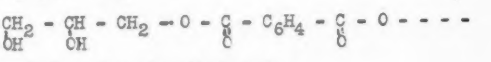
Vinyl acetate . . . CH_2= CH - OAc

Polymerized resin .

Glycerin base resins

Glycerine . . . . .

Phthalic acid . . . $C_6H_4(COOH)_2$

Condensed resin . . 

Possible reactions in formation of synthetic resins.

cules to develop branched and interwoven structures.

Catalysts are usually added to increase the rate of reaction so that lower temperatures can be used during manipulation. This reduces the excessive decomposition of the organic materials. The use of catalysts does not prevent the formation of short chain, nonresistant compounds, and they cannot be employed indiscriminately.

In addition to the resins mentioned above, there are a number of products that have shown excellent properties, but most of them have not found their way into dental technology. Urea-formaldehyde and styrol compounds have many desirable qualities, as well as the polyindene compounds. The petroleum resins may also find a more extensive use.

Vinyl resins have shown especially valuable chemical and physical properties and have found extensive commercial uses, notably in the "long playing" phonograph records. They are well suited to dental prosthesis, with the important exception that occasionally a brittle product is obtained. This phenomenon is difficult to explain, except as a result of improper pressing or continued reaction after the denture has been placed in the mouth. Standardization of processing technics by scientific tests of tensile strength and elongation might easily solve this problem.

The development of synthetic resins for dental use has been left almost entirely to the commercial manufacturers. The testing methods, as presented to the dental profession, have often consisted of the most unscientific demonstrations. The fact that a completed denture does not fracture when dropped from a sixteen story building is cited as definite proof that the material of which it was made is suitable for use in the mouth. As opposed to this method, Dr. Hughes is to be complimented on his work on resins used in dental prosthesis.[1] He has developed an adequate comparative chart for evaluating the various materials on the market and it can be seen from this chart that there is no perfect denture material on the market. The selection of a commercial product for a particular case depends on the peculiarities of the oral condition, as well as the economic and esthetic factors. By consideration of all of the pertinent factors and reference to a chart that gives the individual properties and advantages of each product, the most suitable choice can be made by the practitioner.

If the information tabulated on the chart is kept abreast of the times, the members of the dental profession will always be able to select the best materials for each case and need not be dependent on information supplied by the manufacturers or the dental laboratories.

1. Hughes, G. A.: Denture Materials, J.A.D.A., 23:621 (April) 1936.

COORDINATING TREATMENT WITH DIAGNOSIS*

By JOSEPH H. WILLIAMS, D.D.S., St. Louis, Mo.

IN preparing a paper to present before the Section on Orthodontia, one naturally thinks of the general practitioner in dentistry who includes in his practice the treatment of orthodontic cases, and not of the dentist who, through special training and experience, is able to limit his practice to orthodontia.

Owing to economic stress and the falling off of many practices within the last few years, an increasing number of men have seen fit to attempt orthodontic treatment, some with little training other than they received in their college course.

It seems to be the opinion of many individuals that a knowledge of appliance construction is all that is necessary for the practice of orthodontia. A review of orthodontic literature of the past ten years will convince one that the main problem of our specialty today is not one of mechanics, but rather of growth and development. Our literature is filled with articles upon the subject of tissue changes and growth, and woe be unto the man who attempts the practice of orthodontia without some knowledge of these allied sciences.[1]

It is not the purpose of this paper to keep the general practitioner from treatment of orthodontic cases. It is an effort to help him solve some of the problems with which he is confronted.

Within the past ten years, considerable progress has been made in the diagnosis of dental anomalies. While none of the methods in use today are perfect, it is a recognized fact that the old method of intra-oral diagnosis, with casts carved on a plane with the laboratory bench, has been found wanting. No doubt, many failures can be attributed to wrongly diagnosed conditions and improperly planned treatment.

To plan and coordinate treatment, one must know the position of all malposed teeth in their relation to the skull of the particular person whom he is treating. At the present time, I know of no better method of accomplishing this than with the use of the gnathostat.

There are many who look on the gnathostatic system of diagnosis as a complicated complex method of casts, graphs, charts, etc. This is no doubt due to the way in which this system has been presented to the profession in lectures and papers by men who have stressed the scientific rather than the practical side of the subject. There are many dental anomalies that can be properly diagnosed, and treatment planned and carried through, from gnathostatic casts alone, without the drawing of any graphs at all.

I do not mean to belittle the value of charts and graphs: they are of scientific value, but can be eliminated in certain type cases. On the other hand, there are those cases wherein graphs will aid in diagnosing and planning treatment and will often help us to avoid difficulties.

Figure 1 shows a case in which the

*Read before the Section on Orthodontia at the Seventy-Seventh Annual Session of the American Dental Association, New Orleans, La., Nov. 5, 1935.

1. Williams, J. H.: Orthodontic Appliances as Used by American Board of Orthodontia, 1935.

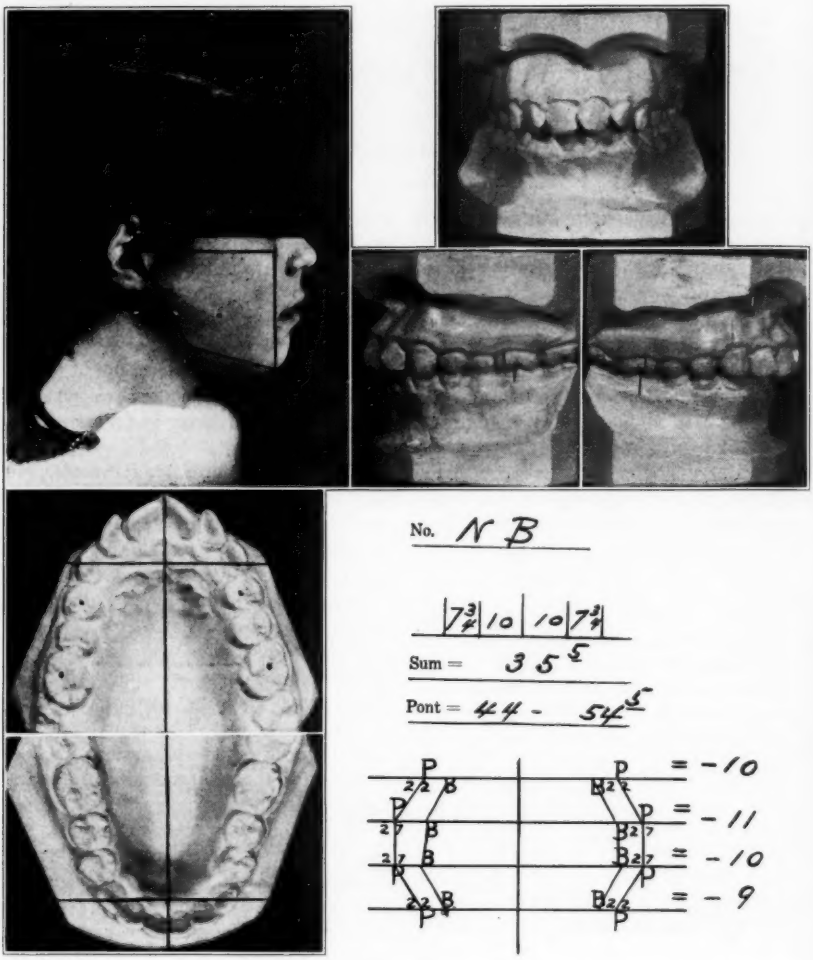


Fig. 1.—Lateral graph, indicating amount of expansion necessary in molar and premolar region.

lateral graph will immediately reveal how impossible it is to expand the maxillary arch enough to make room for the four anterior teeth that are rotated. According to Ponts' index, the distance between 4 and 4 should be 44 mm. in order to accommodate these teeth, while the present width of the arch between 4 and 4, as shown on the cast, is only 34 mm., a difference of 10 mm. Should one succeed in expanding the maxillary arch this amount, it would be out of harmony

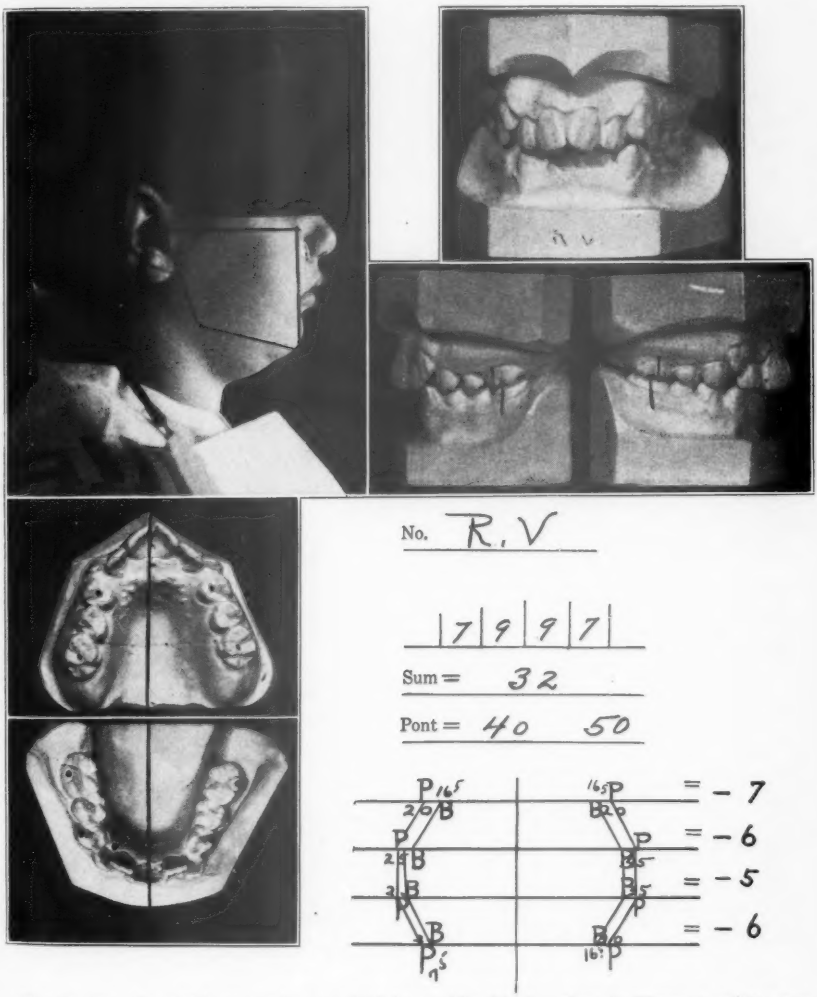


Fig. 2.—Case in which expansion required is considerably less than in Figure 1, with more favorable prospects for permanent result.

with the mandibular arch, owing to the width of the lateral incisors, 7.75 mm.

Figure 2 shows a similar case wherein the expansion required is considerably less and the prospects for a permanent result are favorable. These conditions may escape the notice of even the experienced operator, but rarely will when studied and diagnosed in this way.

Figure 3 shows a case wherein the occlusal graph will aid in diagnosing, and, like the lateral graph in the former case,

will help one to avoid difficulties. In this case, we are interested in knowing the relation of all the teeth to the occlusal plane, which would be difficult to determine by examining the cast alone, especially one made in the ordinary way. The graph tells us that the maxillary incisors are almost in their normal vertical positions. The mandibular incisors are in supraclusion, and there is a lack of vertical development in the bicuspid and molar regions, especially in the maxillary arch.

In addition to having gnathostatic casts and a limited number of graphs to aid in diagnosing and planning treatment of our cases, we should have photostatic pictures. Regardless of the method used in diagnosing cases, the photostatic camera will aid in determining the extent of an anomaly.

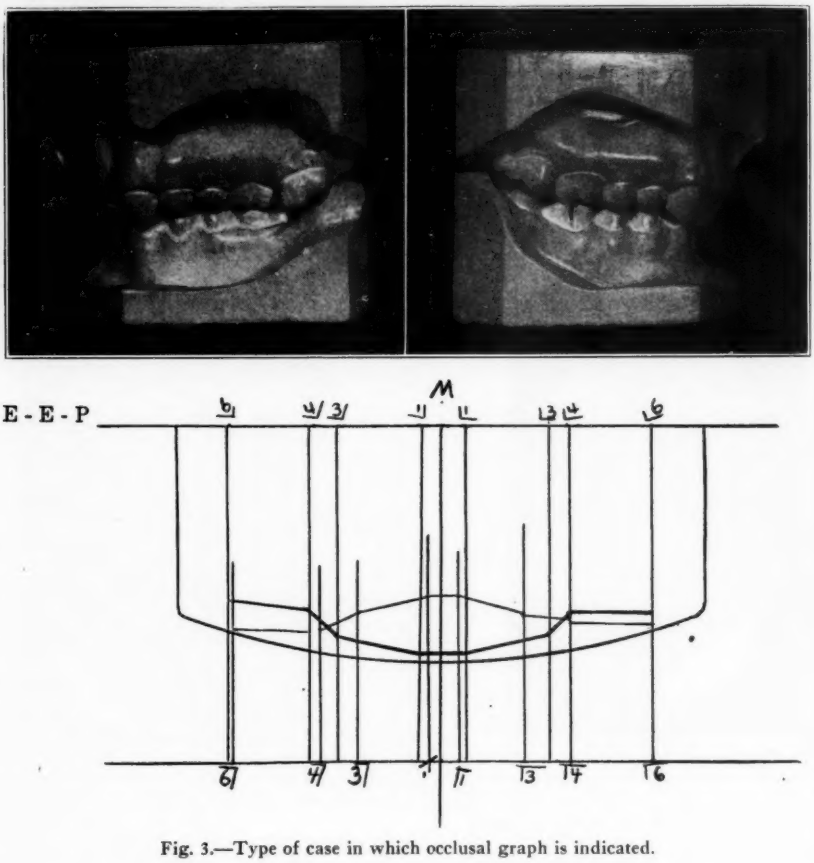


Fig. 3.—Type of case in which occlusal graph is indicated.

Figure 4 shows four cases that, when

studied with casts alone, especially if made in the ordinary way, will all appear to be the same type (distal or posterior occlusion). With the aid of photostatic pictures, a somewhat different diagnosis of each will be made. Figure 4 *a* is complicated by a lack of development in the body of the mandible. *b* is complicated by a lack of development in the ramus. In *c*, there is a lack of development in both the ramus and the body of the mandible, while *d* shows the mandible well developed and the trouble is only with the teeth and the surrounding tissue, the alveolar process. The first three cases are more difficult to treat, require much longer time and are more liable to relapse. In treating such cases, one must resort to muscle training[2] as advocated

Fig. 4.—Four posterior occlusal cases in which photostatic pictures are an aid in making diagnosis.

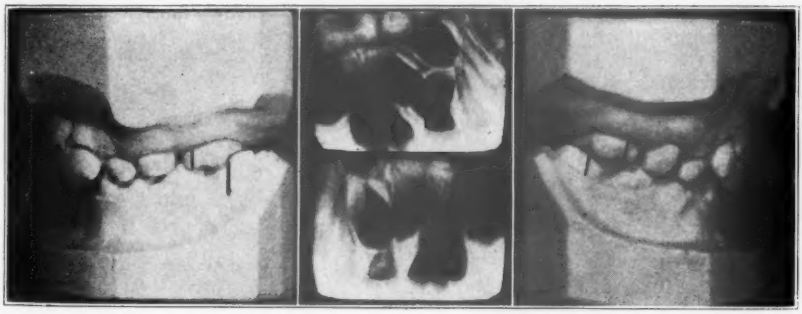


Fig. 5.—Case that can be diagnosed and treatment planned without graphs.

2. Rogers, Alfred Paul: Application of Exercises, Internat. J. Orthodon., 4:272-296 (June) 1918; Muscle Training and Its Relation to Orthodontia, Internat. J. Orthodon., 4:555-577 (Nov.) 1918; Teaching Patients to Overcome Undesirable Muscle Habits, Internat. J. Orthodon., 4:433-438 (Aug.) 1919; Stimulating Arch Development by Exercise of Masseter-Temporal Group of Muscles, Internat. J. Orthodon., 8:61-64 (Feb.) 1922; Increased Function in Treatment of Dental Anomalies, Internat. J. Orthodon., 15:731-745 (Aug.) 1929.

by Alfred Paul Rogers. The fourth case of this group, to judge from the appearance of the cast, would seem to be the most extreme, but is the easiest to treat and the results are more nearly permanent. The value of photostatic pictures as used with the gnathostatic system can thus readily be seen.

As stated before, to plan and coordinate treatment successfully with diagnosis, we should know the position of all teeth in their malrelation and the direction and amount of movement necessary to place them in harmony.

Figure 5 shows a case of malocclusion the cause of which probably was early loss of the upper second deciduous molars. An intra-oral diagnosis with casts carved on a plane with the laboratory bench may lead one to think that the upper first permanent molars have migrated forward and are occupying the space where the second bicuspid should erupt. Roentgenograms would also indicate this to be the case.

When a gnathostatic diagnosis is made, the true position of the teeth in relation to the patient's skull is determined. (Fig. 6.) The upper first permanent molars are in their normal mesiodistal positions and there is a lack of development in the anterior portion of the arch (a dento-alveolar retraction). The mandible is in distoclusion.

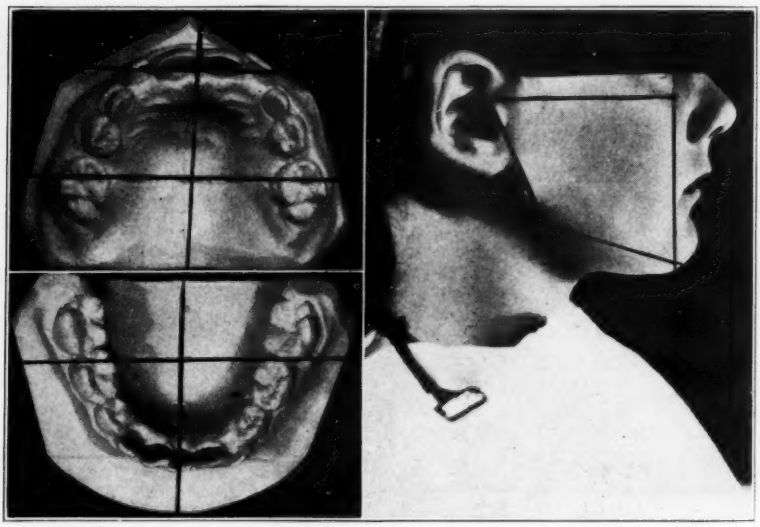


Fig. 6.—Case that can be diagnosed and treatment planned without graphs.

Treatment was planned and carried out according to this diagnosis. The maxillary central and lateral incisors were gradually moved forward, space being made for the bicuspids and cuspids. Intermaxillary elastics were then used to move the mandible forward.

Figure 7 shows a similar case wherein the gnathostatic cast will be an aid in planning treatment. The maxillary first

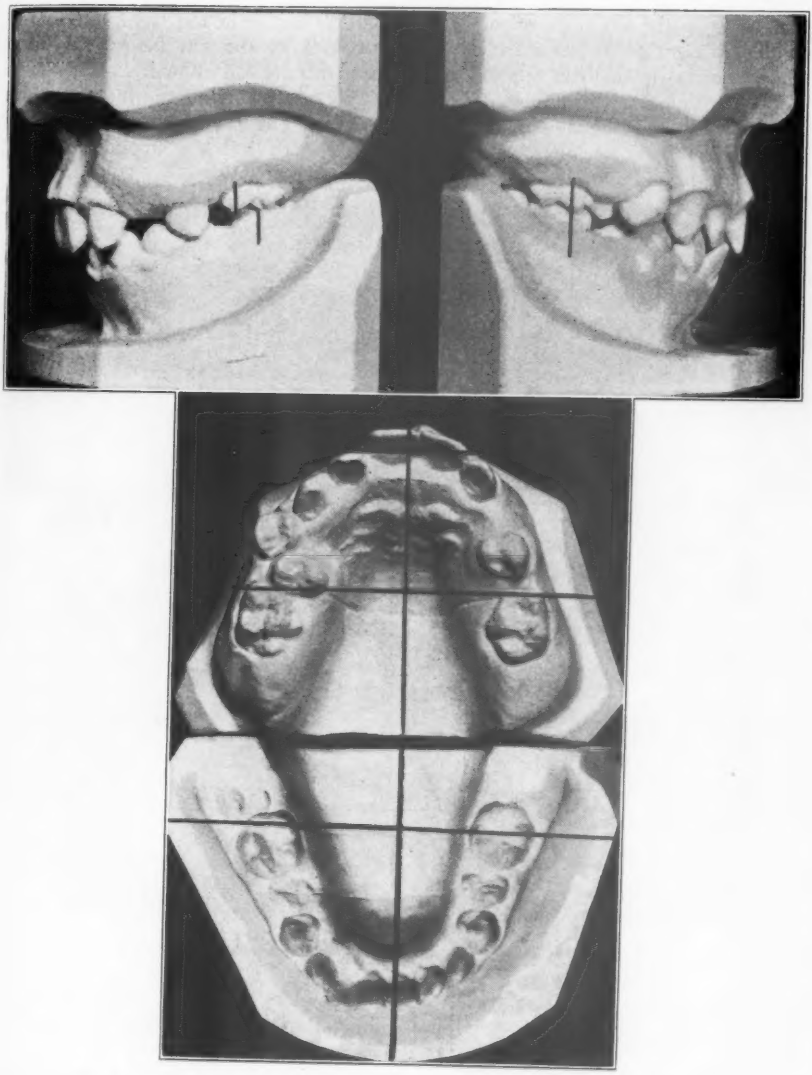


Fig. 7.—Case that can be diagnosed and treatment planned without graphs.

permanent molars are in their normal mesiodistal relation, the lack of development being in the anterior region. The mandibular right molar and bicuspids are in their normal mesiodistal relation and all the remaining teeth in this arch are placed distally and lingually.

Figure 8[3] shows a case that can be easily diagnosed and its treatment planned from gnathostatic casts and photostatic pictures without graphs. The casts tell us that the maxillary teeth are in their normal mesiodistal relation, but are displaced lingually. The right mandibular molar is in its normal mesiodistal relation, but from the right lateral incisor back to the left molar, they are placed distally and lingually.

This case was treated in the following manner: The maxillary arch was expanded with a labial appliance. The mandibular appliance consisted of a lingual wire 0.040 in size, soldered to the right molar band and extending to the left cuspid. An 0.036 wire was soldered to this and inserted in a horizontal tube on the left molar band. Auxiliary springs of 0.022 wire were used. Inter-

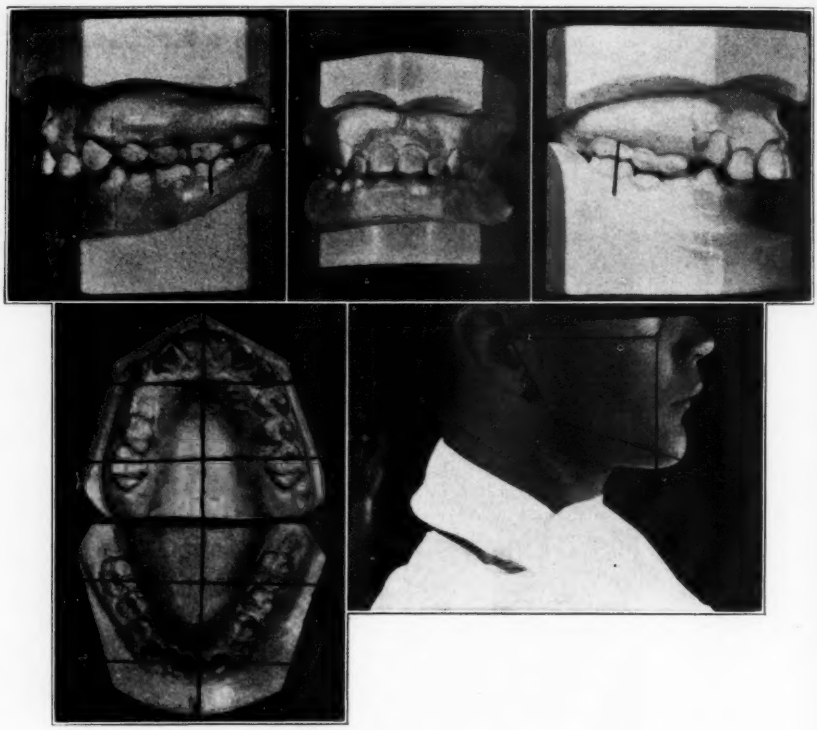


Fig. 8.—Case diagnosed from gnathostatic casts without graphs.

3. Williams, J. H.: Report of Six Treated Cases, American Board of Orthodontia, 1935.

maxillary elastics were used on the left side.

Figure 9 shows pictures of the case after treatment.

Figure 10[8] demonstrates the advantage of knowing the exact position of individual teeth in their relation to the skull. Treatment can be more accurately planned and time saved. Gnathostatic casts reveal the following: a lingual displacement of the mandibular teeth on the left side from the first molars to the central incisors, slight constriction of the maxillary arch, displacement of the anterior teeth to the left, with the left buccal teeth placed slightly mesially, crowding the cuspid out of the arch.

A labial arch made of edgewise arch wire and 0.036 round wire was used to treat the maxillary arch. A removable lingual arch of 0.040 round wire with a 0.022 auxiliary spring was used on the mandibular arch. Edgewise bracket bands were used on the maxillary incisors. The appliances were placed on the teeth, Aug. 11, 1931, and owing to the fact that the patient lived 90 miles from the city, treatments were at three-week intervals.

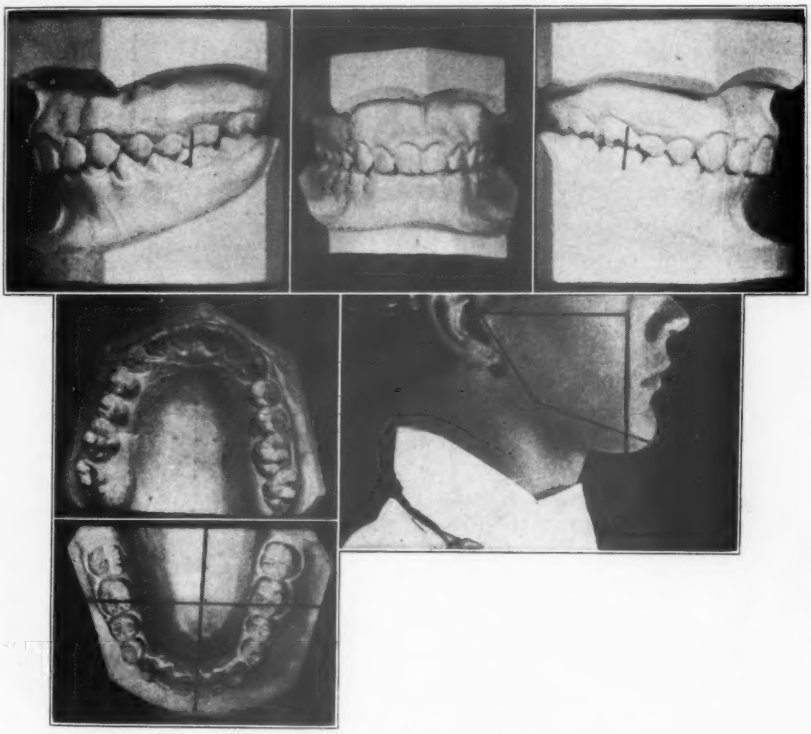


Fig. 9.—Case shown in Figure 8, after treatment.

Figure 11 shows the case after treatment.

While a correct diagnosis is necessary, it is just as important to know the etiology of a case of malocclusion before planning treatment. It is not possible to discuss the various causes of malocclusion that the orthodontist comes in contact with. It would be well worth while for the man in general practice who is treating orthodontic cases to acquire as much knowledge of the etiology of malocclusion as possible. Relapses sometime occur because the operator did not recognize the cause of the condition in the beginning. It does not take much pressure to move teeth, and the muscles of expression and mastication can become wonderful orthodontic appliances to undo what has been accomplished mechanically, through some perverted activity.

Every case that is presented for treatment is a study in itself. A careful analysis must be made of each patient. Normal occlusion does not just happen, but is brought about by certain definite functional forces peculiar to each individual. The inclined planes of the teeth, the muscles of the tongue, lips and cheeks and many other influences all have their

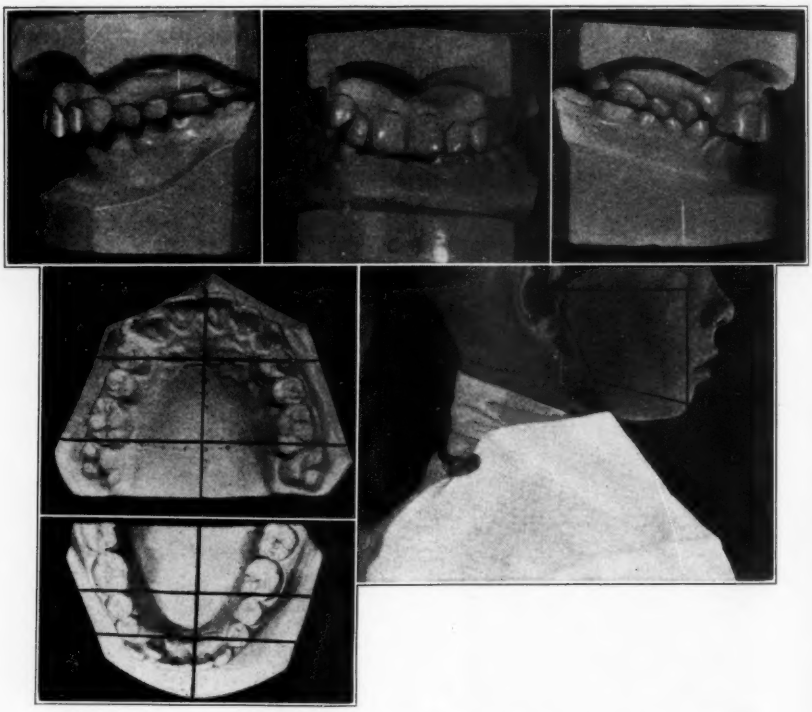


Fig. 10.—Case showing advantage of gnathostatic casts in locating malposed teeth.

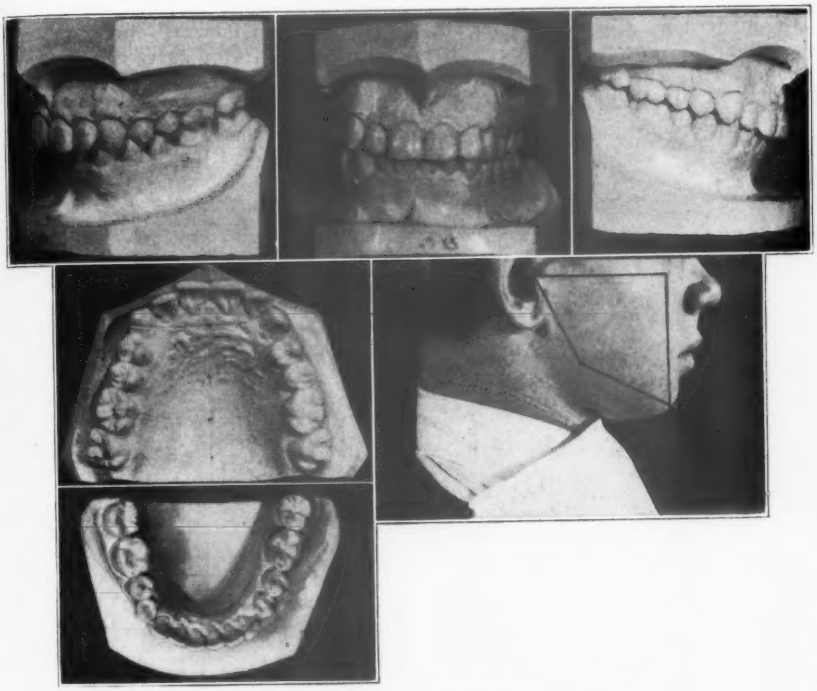


Fig. 11.—Case shown in Figure 10, after treatment.

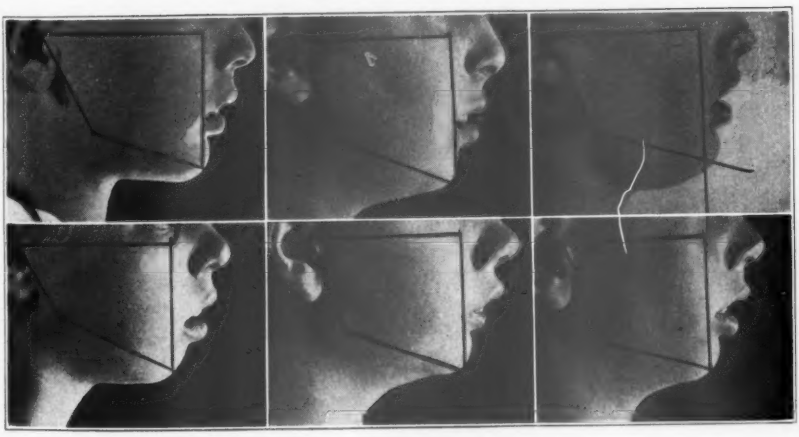


Fig. 12.—Effect of disuse of facial muscles.

part in forming and maintaining the dental arch. The fact that we are dealing with an abnormality is frequently evidence that one or more of these forces may be improperly functioning.

tion frequently observed during the act of swallowing. In the treatment of such cases, I again call attention to the work of Dr. Rogers.[2]

Figure 14 shows a series of allergic cases (hay fever). Relapses are frequent

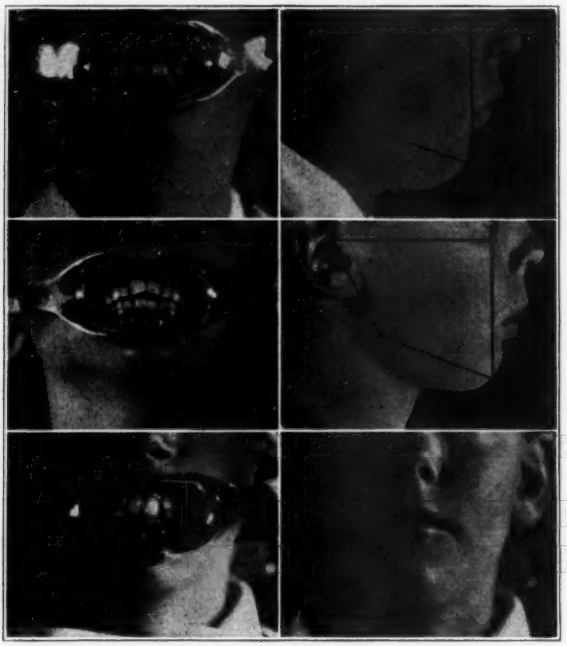


Fig. 13.—Case in which muscles of lips and cheeks exert undue pressure.

Figure 12 shows a series of cases of disuse of the facial muscles (hypotonicity). Such conditions are frequently the cause of malocclusion because there is lack of proper support for the bony structure.

Figure 13 shows the opposite condition, the muscles of lips and cheeks exerting undue pressure, which prevents development of the bony tissue; a condi-

in these cases owing to persistent mouth breathing.

It can thus be seen that the treatment of orthodontic cases is not just a matter of placing mechanical appliances on the teeth, but involves the whole field: diagnosis, etiology, prognosis, etc.

The theory and practice of orthodontia is a big subject, almost as large in

scope as the practice of dentistry itself. It is a serious thing in any branch of the healing art to subject patients to unskilled treatment, especially when these patients are children. A mistake or failure in the making of a bridge or an inlay or a denture can be corrected with little discomfort to the patient. A failure made by the orthodontist proves to be a living monument, walking the streets to confront him on all occasions, with no end of disappointment to the patient.

We have made progress, but there remains much to be learned. May the time come when our knowledge of diagnosis will enable us to more accurately coordinate treatment.

Fig. 14.—Allergic cases.

200 Beaumont Medical Building.

FIELD STUDIES AMONG SOME AFRICAN TRIBES ON THE RELATION OF THEIR NUTRITION TO THE INCIDENCE OF DENTAL CARIES AND DENTAL ARCH DEFORMITIES*

By WESTON A. PRICE, D.D.S., M.S., F.A.C.D., Cleveland, Ohio

TOOTH decay is one of the modern paradoxes since many primitive races were largely free from it, while modern civilizations are nearly all scourged by it. The purpose of these several field studies among primitive racial stocks is to throw light on the reasons for the present dilemma.

The remnants of primitive racial stocks previously studied and reported all had environments which are quite different from those that are provided in the interior of a large continent. It has, accordingly, been desirable to make investigations among primitive racial stocks situated where physical conditions were more nearly comparable to those which obtain in agricultural areas of Europe and America.

For this purpose, the interior of Africa was selected for the special studies that were made during the summer of 1935. The continent was entered on the east coast at Mombasa. Tribes with differing dietary habits were selected and studied in Kenya, Uganda, Belgian Congo and the Sudan. A study was made of the native life in Port Said, Port Sudan on the Red Sea and Aden, Arabia, en route to Mombasa. The itinerary is outlined on the map shown in Figure 1. In order to make contact with as nearly primitive groups as were available, assistance was obtained from government officials and missionaries in direct contact with these tribes. Both guides and interpreters were obtained from these sources. By correspondence, special arrangements had been made in advance through high officials. The procedures consisted, as in previous studies of primitive racial groups, in making examinations of the teeth and the form of the dental arches and recording these data both in photographs and in clinical records. Over 2,500 negatives were made and developed in the field. The distance traveled in Africa was approximately 6,000 miles. Groups were studied at altitudes from sea level to 8,000 feet. The tribes studied were of Hamitic, Nilotic, Bantu and Negro origin. Dietary habits of different tribes varied considerably even in similar districts. The present position of the tribes in relation to each other is apparently largely the result of race movements that have been in progress for many centuries, and while there has been some blending of certain tribes, they have in general retained their distinctive racial characteristics and tribal customs. They can be classified on several different bases. The most convenient for our use will be their nutrition, since, as in previous studies, particular attention has been paid to foods selected.

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-Seventh Annual Session of the American Dental Association, New Orleans, La., Nov. 5, 1935.

MASAI TRIBE, KENYA

We will first consider the Masai, a people of Nilotic origin, primarily cattle herders, who live now, as in the past, the tribes of eastern and central Africa. They occupy a large tract in the central southern game preserve. They live now as in the past in a lion infested country,

Fig. 1.—Itinerary for 1935 field studies.

largely on milk, blood and meat. Physically, they are tall and lithe. They have been accredited with being the most skilled warriors and the bravest of all protecting themselves and their herds with long heavy spears. The British government has denied them the privilege of carrying their shields and has com-

pletely checked their raids on the surrounding tribes. They live in manyatas built of acacia thorn bushes, which effectively shield them and their cattle from raids of lions and leopards and other predatory animals. Their houses, built within the manyatas, consist of a framework of twigs built onto a form and the whole plastered over with the spore of their cattle mixed with clay. The cows are milked morning and evening in the manyatas and from time to time the steers are bled, usually at intervals of from thirty to forty days, in regular sequence, the frequency depending on the efficiency of the pasturage. The method of drawing the blood is unique. A torque is placed around the animal's neck and a special arrow shot from a bow into the jugular vein. The arrow is tipped with a very sharp curved knife, the depth to which it can cut being controlled by a shoulder on the arrow. Obstreperous animals are thrown and hobbled. About 2,000 or 3,000 c.c., from 4 to 6 pints, is obtained in a single drawing. The blood is defibrinated by whipping in the gourd with a stick, which collects the fibrin into a mass. A few ounces of this blood is given to each child daily, the quantity depending on special needs. Pregnant women receive their ration regularly. This is used in conjunction with milk, though not taken with it. The fibrin is cut into slices and fried. Animals are slaughtered sufficiently frequently to provide meat. The blood of slaughtered animals is carefully collected and used for food. Every edible part of the animal is utilized. Great emphasis is placed on the organs. A typical manyata shelters a chief and his family consisting of several wives and children. Each is provided with a separate cabin. There is every evidence of happy contented home life. Their dress frequently consists of a goat skin draped across the shoulder. The men and boys are employed in caring for the cattle and keeping up the corral. The women take care of the food and the homes. The women in general are well built and some are quite good looking. A typical belle with current ornamentation is shown in Figure 2.

A study of 2,516 teeth in eighty-eight persons distributed through several widely separated manyatas shows only four persons with caries, with a total of ten carious teeth, or only 0.4 per cent of the teeth, attacked by tooth decay.

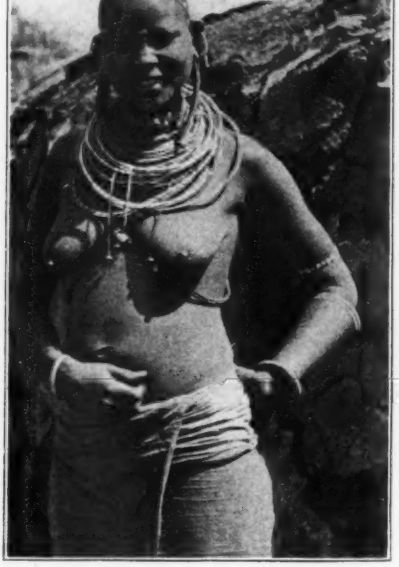


Fig. 2.—Masai girl. Masai girls are married at from 14 to 16 years, being purchased with cattle, the number depending on the bride's beauty.

JALOU TRIBE, KENYA

The Jalou tribe occupies the territory along Lake Victoria and Kisuma Bay.

They are one of the most intelligent and physically excellent native tribes. They were studied in two groups, one at Maseno and the other at Ogado.

The group studied at the Maseno school were boys ranging from about 10 to 22 years, totaling about 190 in all. The principal of the school presented the boys in military formation for inspection. Through him as interpreter I asked that all boys that had ever had toothache hold up their hands. Nineteen so indicated. These were examined and the findings constitute the report for this group. Of the nineteen, only one was found to have caries, two teeth being involved; which, for 546 teeth in those examined, gives a percentage of 0.4 showing caries.

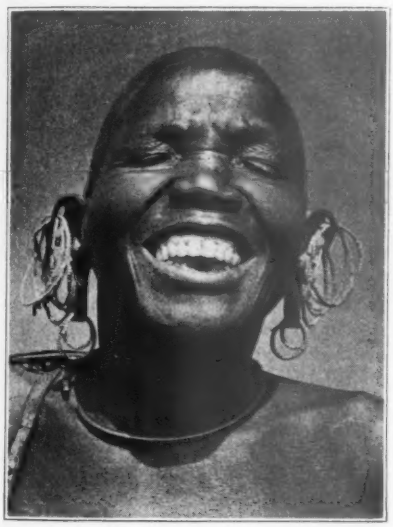


Fig. 3.—Typical Kikuyu woman dressed in skins. The large ear perforations are decorated. The lower incisors have been removed to provide opportunity for feeding in case of lockjaw.

In the Ogada Mission, a study of 258 teeth in ten persons revealed no teeth with dental caries.

JEANNES SCHOOL, KENYA

The Jeannes school located at Kabete is an institution where young married couples are trained in domestic science, agriculture, etc.

In a study of 388 teeth of thirteen persons, thirty-one teeth, or 7.9 per cent, were found to have been attacked by dental caries. These were in six persons, a percentage of 46.1.

PUMWANI MISSION SCHOOL, KENYA

Pumwani Mission School is a native suburb of Nairobi and therefore the inhabitants have recently had European contacts.

In an examination of 588 teeth of twenty-one persons, twenty-six teeth, or 4.4 per cent, had caries.

C. M. S. SCHOOL, NUKURU, KENYA

The children of the C. M. S. school, Nukuru, belong to several tribes, chiefly Jalou. In a study of 312 teeth of eleven persons, only one tooth was found to have been attacked by tooth decay, or 0.3 per cent.

CHEWYA AT KISUMU, KENYA

The natives of Chewya, who belong to the Maragoli tribe, are very strong and physically well developed. They live within easy reach of Lake Victoria, from which they obtain large quantities of fish, this, together with cereals and sweet potatoes, constituting an important part of their diet,

A study of 552 teeth of nineteen persons revealed only one tooth with dental caries, or 0.2 per cent.

KIKUYU TRIBE, KIAMBU, KENYA

In contrast with the Masai, the members of the Kikuyu tribe, which inhabits

a district to the west and north of the Masai, are primarily an agricultural people. Their chief articles of diet are sweet potatoes, corn, beans and bananas. The women use special diets during each gestation and lactation. They are prejudiced against using eggs, although not against chickens.

Dr. Anderson, the physician in charge of a large dispensary, advised me that there is very little pneumonia among the women, but much among the men, and that appendicitis, gallbladder trouble, cystitis and duodenal ulcer are practically unknown among the primitive natives who come to his hospital for care and treatment.

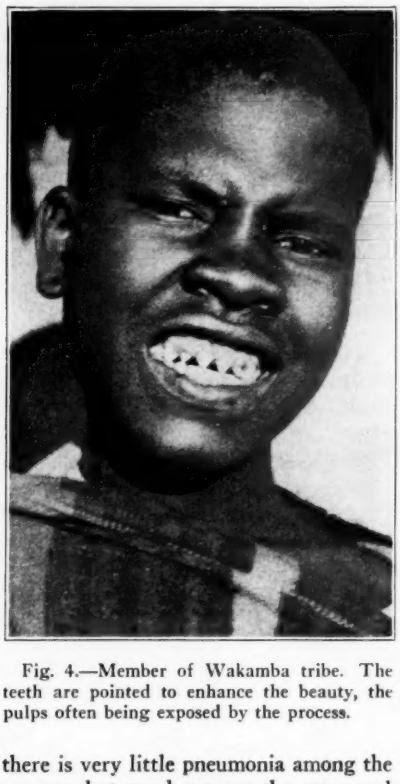


Fig. 4.—Member of Wakamba tribe. The teeth are pointed to enhance the beauty, the pulps often being exposed by the process.

The Kikuyus are not so tall as the Masai and physically they are much less rugged. They, like many of the central African tribes, remove some of the lower incisors at the time these permanent teeth erupt. This custom is reported to have been established for the purpose of feeding in case of lock-jaw. One of the tribal customs which are striking is the making of large perforations in the ears, in which many metal ornaments are carried. A typical Kikuyu woman is shown in Figure 3.

A study of 1,041 teeth in thirty-three persons showed fifty-seven teeth with caries, or 5.5 per cent of the teeth in 36.4 per cent of the persons affected.

Much of the territory occupied by the Kikuyu tribes was formerly forest. Their practice has been to burn down a section of forest in order to get new lands for planting. As soon as the virgin fertility was exhausted, which is usually in from three to five years, they burn down another section of forest. By this process, they have largely denuded their section of Kenya of its timber. This has resulted in a great wastage of building material. There are few stands of native forest within easy reach of transportation.

WAKAMBA TRIBE, KENYA

The Wakamba tribe has a practice of pointing their teeth as shown in Figure 4. They occupy the territory to the east of the Masai, who, in past centuries, have driven themselves as a wedge between the Kikuyu and the Wakamba tribes. The Masai, until checked, carried on a relentless warfare, consisting largely of raids, in which they slaughtered the men, carried off the women and children and drove away the cattle or goats. The Wakambas are intellectually superior to the Kikuyus and have distinct artistic skill in carving of art objects. They are

very mechanical and like machinery. Many of them have important positions in the shops of the Kenya and Uganda railway.

An examination of 1,112 teeth of thirty-seven persons showed sixty-nine teeth with caries, or 6.2 per cent. Twenty-one and six-tenths per cent of the persons studied had dental caries.

MUHIMA TRIBE, UGANDA

The Muhima tribe resides in southern Uganda. They, like the Masai, are primarily a cattle raising people and live on milk, blood and meat. The district in which they live is to the east of Lake Edward and the Mountains of the Moon. They constitute one of the very primitive and undisturbed groups. While the Masai raised chiefly the hump-backed cattle, the herds of this Ankola tribe are characterized by their large wide-spread horns. Like the Masai, the Muhima tribesmen are tall and very courageous. They defend their herds and their families from lions and leopards with their primitive spears. Like the other primitive cattle-raising people, they dominate adjoining tribes.

In a study of 1,040 teeth of thirty-seven persons, not a single tooth was found with dental caries.

BUGANDA TRIBE, MASAKA, UGANDA

Uganda has been called the Garden of Eden of Africa because of the abundance of plant foods, chiefly bananas and sweet potatoes, and abundant fresh water fish and animal life. The natives are thrifty and mentally superior to those of most other districts. They have a king and a native parliament, which the British Government recognizes and entrusts with local administrative affairs. A typical group was studied in a mission at Masaka. An examination of 664 teeth of twenty-one persons revealed only three teeth showing caries, or 0.4 per cent.

NYANKUNDE MISSION, IRUMU, BELGIAN CONGO

The group at the Nyankunde mission is made up of members of the following tribes: Bahema, Babira, Alur and Balendu. We will consider the representatives of these different tribes collectively because of their living largely on a common dietary, consisting chiefly of cereals. Only the Bahemas of this group have small herds of cattle. Some of the others have a few goats. The district is located southwest of Lake Albert.

A study of 6,461 teeth of 217 persons revealed 390 teeth with dental caries, or 6 per cent. Thirty-eight and seven-tenths per cent of the group examined suffered from dental caries.

BOGORA MISSION, BELGIAN CONGO

The Bogora mission, located west of Lake Albert, includes members of the Bahema and Balendu tribes. While the Bahema tribe originally lived very largely on cattle products, milk, blood and meat, in this district the herds were small and a considerable quantity of cereals, chiefly corn and beans, were used; also sweet potatoes and bananas. The latter were the chief foods of the other tribes, with a little goat's milk.

An examination of 2,196 teeth of seventy-seven persons revealed 160 teeth with caries, or 7.2 per cent. Fifty-three per cent of the group had caries.

KASENYI PORT, LAKE ALBERT, BELGIAN CONGO

The natives at Kasenyi Port were members of several tribes surrounding this district who were largely temporarily resident as laborers. These people had been living largely on a cereal diet and now, during their temporary residence at the port, had had fish.

An examination of 1,940 teeth of sixty-three persons revealed 120 teeth with dental caries, or 6.1 per cent of the teeth. Fifty and eight-tenths per cent of the group had dental caries.

WEST NILE LABORERS FROM BELGIAN CONGO

The West Nile laborers studied at Masaka, Uganda, represent a very strong and dependable group, coming from districts north of Lake Albert in the Belgian Congo. They are, accordingly, much sought for in industrial enterprises, and they are often moved in groups for a considerable distance.

A study of 320 teeth of ten persons revealed that no teeth had ever been attacked by decay.

PYGMIES, ITURU FOREST, BELGIAN CONGO

The Pygmies of Ituru Forest are said to have originally lived in trees and formerly were exceedingly shy and difficult to make a contact with. We were taken to several of their villages in the heart of the dense Ituru forest and found them very well disposed through the confidence that has been established by the mission workers. Their shyness, together with the difficulty of making them understand through two transfers of languages, made an examination of their teeth very difficult.

A study of 352 teeth of twelve persons revealed eight teeth that had been attacked by tooth decay, or 2.2 per cent.

WANANDE TRIBE, BELGIAN CONGO

The Wanande tribe is located at Lubero in the Belgian Congo. Their diet consists largely of bananas, sweet potatoes, cereals and goats' milk.

In an examination of 368 teeth of thirteen persons, there were eight teeth with caries, or 2.2 per cent in 15.4 per cent of the group.

BAITU TRIBE, NYUNGE, RUANDA, BELGIAN CONGO PROTECTORATE

Nyunge, Ruanda, lies south of Uganda, east of Belgian Congo proper and northwest of Tanganyiki. It lies just east of Lake Kivu. When we realize that Lake Kivu was only discovered in 1894, even though it is one of the important sources of the Nile waters, we understand the primitiveness of the people of this and adjoining districts. This group lives largely on dairy products from cattle and goats; together with sweet potatoes, cereals and bananas.

In a study of 364 teeth of thirteen persons, not a single tooth was found to have been attacked by dental caries.

NATIVE HOTEL STAFF AT GOMA, BELGIAN CONGO

The group studied at Goma consisted of the inside and outside servants of a tourist hotel on Lake Kivu.

An examination of 320 teeth of ten persons revealed twenty teeth with caries, or 6.3 per cent. It is of interest and significant that all of these twenty carious teeth were in the mouth of one person, the cook. The others all boarded themselves and lived on native diets. The cook used European menus.

TERRAKEKA, UPPER NILE, SUDAN

The people of Terrakeka are tall and live largely on fish and other animal life. This part of the Sudan consists of a large district, a marshland called the Sudd. It is covered with rank papyrus from 15 to 30 feet high. This jungle of rank marsh growth swarms with a wide variety of animal life, large and small.

An examination of 548 teeth of eighteen persons revealed not a single tooth had been attacked by dental caries.

NEURS, MALAKAL, SUDAN

The Neurs, at Malakal on the Nile

River, are a unique tribe because of their remarkable stature. Many of the women are 6 feet tall and the men range from 6 to 7½ feet in height. Their food consists very largely of the animal life of the Nile, dairy products and milk and blood from the herds.

A study of 1,268 teeth of thirty-nine persons revealed only six teeth with dental caries, or 0.5 per cent. Only three persons had caries, or 7.7 per cent.

DINKAS, JEBELEIN, SUDAN

The Dinkas live on the Nile. They are not so tall as the Neurs, but they are physically better proportioned and have greater strength. They use fish from the Nile and cereals for their diet. They decorate their bodies profusely with scars. A typical belle is seen in Figure 5.

An examination of 592 teeth of twenty-two persons revealed only one tooth with caries, or 0.2 per cent.

ARAB SCHOOLS AT KHARTOUM AND OMDURMAN, SUDAN

The Arabs are the chief occupants of the territory of Northern Sudan. Omdurman on the west bank of the White Nile opposite Khartoum is the largest purely Arab city in the world. It has been but slightly influenced by modern civilization. Khartoum, on the contrary, just across the river from Omdurman and the capital of Anglo-Egyptian Sudan, has districts which are typically modern. These include the government offices and administration organization. The Arab section of Khartoum has been definitely influenced by contact with these Europeans. This makes possible a comparative study of similar groups in these two cities: modernized Khartoum and primitive Omdurman.

A study of 1,284 teeth of fifty-two persons in an Arab school at Khartoum revealed that fifty-nine teeth, or 4.7 per cent, had been attacked by dental caries, 44.2 per cent of the persons studied being affected.

In Omdurman, a study of 744 teeth in thirty-one persons revealed only nine teeth that had been attacked by tooth decay, or 1.2 per cent. In this group, only two, or 6.4 per cent, of the group had dental caries.

The groups examined, which were selected with the assistance of the government officials, consisted of the higher grade pupils in two advance native schools, one in Khartoum and one in Omdurman.

Fig. 5.—Women from a tribe of the Upper Nile valley. Several of these tribes decorate their bodies with scar designs produced by rubbing ashes into deep cuts. The scars here shown are typical.

It is of interest that of the two boys in the Arab school at Omdurman with dental caries, one was the son of a rich merchant and used liberally sweets and European foods.

NATIVE HOSPITAL, KHARTOUM, SUDAN

The persons studied in the native hos-

pital at Khartoum were from quite remote areas distributed through Sudan. Some had traveled many days on camels to obtain the help that the hospital provided.

A study of 288 teeth of ten persons revealed thirteen that had been attacked by tooth decay, or 4.5 per cent.

IKHLAS SCHOOL, CAIRO, SUDAN

Ikhlas is a native school in which the students are comparable in many respects to those in the native schools at Khartoum and Omdurman. Their nutrition is highly modernized by living in a modern city.

A study of 2,092 teeth of eighty-five persons revealed that 353 teeth, or 12.1 per cent, had been attacked by decay. Seventy-five per cent of the members of this group had dental caries.

The total number of teeth examined in the preceding groups was 28,438. Of this number, 1,346 were found with dental caries, or 4.7 per cent. This represents a total of 1,002 persons examined, of whom 300 had one or more carious teeth or teeth that had been lost by caries; i.e., 29.9 per cent of the group had dental caries. Of this total number of twenty-seven groups studied, there were several groups with practically complete immunity to dental caries, while other groups had a relatively high incidence of caries. The data will be analyzed further under comment.

FACIAL AND DENTAL ARCH DEFORMITIES

The purpose of these studies has included the obtaining of data which will throw light also on the etiology of deformities of the dental arches and face, including irregularity of position of the teeth.

A very marked variation of the incidence of irregularities was found in the different tribes, which could be directly associated with the nutrition rather than with the tribal pattern. The lowest percentage of irregularity occurred in the tribes living very largely on dairy products and marine life. For example, among the Masai, living on milk, blood and meat, only 3.4 per cent had irregularities. Among the Kikuyu and Wakamba, 18.2 and 18.9 per cent, respectively, had irregularities. These people were largely agriculturists, living primarily on vegetable foods. In the native Arab school at Omdurman, conducted almost entirely according to the native customs of selection and preparation of foods, 6.4 per cent of students had irregularities, while at the native school at modernized Khartoum, 17 per cent had irregularities. In the Ikhlas school at Cairo, under modern influence, 16.5 per cent had irregularities. In the native hospital at Khartoum, 70 per cent had irregularities. In the Pygmy group, 33.3 per cent had irregularities, and among the grain eaters of the west Nile, 25.5 per cent. Among the families of the old established missions at Nukuru, 54.5 per cent had had irregularities. At the Jeannes school, 46.1 per cent, and at the Ogada mission, 30 per cent showed irregularities.

COMMENT

In order to make direct application of the data obtained in these African studies, it is important to relate these new facts to those formerly obtained among other primitive groups and to note the difference in the physical environment of the various groups studied. In general, these African studies have been made in the tropics. The studies previously reported were made in the North Temperate and South Temperate and Arctic Zone. The climate is a factor, since, in the cold climates of the winters in the high Alps for the Swiss, and for

the Eskimos and Indians of the far North, there is required the consumption of considerably more food in order to provide the body with necessary heat and energy. In the Southern Pacific archipelagos, the salubrious climate would invite lethargy and naturally reduce the amount of foods required for maintaining body temperature. The natives of Equatorial Africa, except those at altitudes above 5,000 feet, have hot weather for two periods each year during the day, and even at 5,000 feet, the temperature is moderate at night, so that rest is easily obtained. For the residents of altitudes of less than 2,000 feet, heat is often extreme for several months of the year. We have accordingly a wide range of climatic conditions represented in the various racial groups studied.

It is important to review the efficiency with which the persons in these several groups were maintaining a high immunity to dental caries and to determine what the variable factors were in those members of the group who had lost their immunity to caries. It is important to note, at the same time, the wide variation of diets that are available and the foods consumed by the several groups, since the available foods constitute an important part of the local environment.

For the people of the isolated valleys of the high Alps studied in 1931 and 1932, the diet was found to be largely dairy products of especially good quality and entire rye, used chiefly as whole rye bread. The diet of the residents of Switzerland in the plains country and cities consisted of the items of foods used in modern civilization, including white flour products, sweetened foods of various kinds, particularly marmalades and jams, and other canned foods. The incidence of dental caries for the individual studies in the isolated Swiss valleys was found to be 4.6 per cent of the teeth studied. For the highly modernized communities, the incidence of caries was from 24.7 per cent at Herisau in the plains country to 29.8 per cent at the summer resort of St. Moritz, also at a high altitude. The climate of Switzerland is delightful the year around. The winters, while stimulating, are not unduly severe.

My studies of the people of the Outer Hebrides, off the west coast of Scotland, in 1932 indicated that in those still living, as their ancestors had, very largely on oat products and sea foods, the incidence of caries was 1.2 per cent of the teeth examined. In those living in the highly modernized ports, 30 per cent of the teeth examined were found to be carious. The climate is bracing, but never extremely cold or hot.

In the Eskimos of western Alaska studied in 1933, living under very severe climatic conditions for most of the year, the percentage of teeth found to have been attacked by caries was 0.09 per cent. For the Eskimos living at the points of contact with modern civilization and using the imported foods, the incidence of caries was 13 per cent. This involved an increase 144 fold. The food of the Eskimos with high immunity consisted very largely of the animal life of the sea, of which they used chiefly the organs and fat. The isolated groups of Eskimos were reached by airplane. The severity of the winters would necessarily induce the Eskimos to eat a very liberal diet.

My study in 1933 of the Indians of the far north of Canada and along the Pacific coast revealed that, for those in the interior of the far north, where their isolation compelled them to depend on local food entirely, the food was almost completely limited to wild animals of the chase, chiefly moose and caribou. For all these northern Indians studied, the incidence of dental caries was only 0.16 per

cent. It is important that neither these isolated Eskimos nor the Indians had knowledge of modern procedures of oral prophylaxis. For the groups of Indians living near the Hudson Bay Posts and along the Pacific Coast, in contact with modern civilization and transportation facilities, the incidence of dental caries was 21.5 per cent, which is a 134 fold increase. A study of the Indians in six coast towns revealed an average of 40 per cent of the teeth attacked by dental caries. These groups were being taught oral prophylaxis. Two of the principal articles of barter at the Hudson Bay Posts were white flour and sugar.

My studies of 1934 made among the Melanesians and Polynesians of the Southern Pacific Islands provide important data from eight different archipelagos, the inhabitants of which were of different racial stocks and spoke different languages. Six of these archipelagos were populated with Polynesians and two with Melanesians. The incidence of dental caries among the Melanesians who were still sufficiently isolated to be dependent on native foods was 0.38 per cent of the teeth studied. For those living at the ports and using trade foods in considerable quantity, 29 per cent of the teeth studied had been attacked by tooth decay. For the isolated Polynesians still living on native foods, the incidence of dental caries was 0.32 per cent of the teeth studied. In the groups in contact with modern civilization, 21.9 per cent of the teeth were attacked by dental caries. Their salubrious climate and the ease with which food could be obtained was not inducive to an appetite comparable to that of the Eskimos and Indians of the far north. The contact with modern civilization in these various archipelagos was almost entirely limited to the calling of trader ships except in a few large ports where passenger ships call regularly or frequently. The almost universal rule for exchange required white flour and sugar products, 90 per cent, and clothing, 10 per cent, as payment for the local products purchased. It is of interest that, in all these groups, the diets of those that had a high immunity to dental caries consisted of native foods, while the diets of those who were suffering from a loss of immunity to dental caries were limited to the foods less valuable for growth and repair. The foods used by those inhabitants of the South Sea Islands who had high immunity to dental caries consisted of a liberal supply of sea animal life eaten with the various native plant foods, vegetables and fruits.

Investigations were made in January and February, 1935, of the Indians living at present in Florida for comparison with studies of the skull material now in various museums and which had been taken from the mounds in Florida. These skulls, which were in an excellent state of preservation, showed practically 100 per cent immunity to dental caries and freedom from dental arch and tooth arrangement deformities. The Seminole Indians living today in Southern Florida can be divided into two groups: first, those living in the Cypress swamps and as nearly as possible restricting their diets to the native foods, such as those the pre-Columbian Indians used, consisting of fish, wild game, birds, alligators, turtles and shell fish, roots and fruits. The quantity of native game and fish now available has been greatly reduced, owing largely to the activities of white hunters, together with the draining of the Cypress swamps and the lessening of the primitive territory by the encroachment of civilization. This first group living in the Everglades has accordingly been compelled to use some store foods. The incidence of dental caries in this group was 4 per cent of the teeth studied. The second, and

by far the largest, group included those Indians along the Tamiami trail and in Miami and vicinity, who are living very largely on modern foods. Forty per cent of all the teeth examined in this group had been attacked by tooth decay. The modern foods consisted of those available in the stores, including white flour products, sweet goods, jams and canned goods together with such of the native foods as they could obtain, though with much difficulty. Because of the scarcity of the native foods in the vicinity of modern civilization, other affections, such as arthritis, were frequently found among the modernized group.

As for the tribes studied in eastern and central Africa in 1935, there was no possibility of their obtaining animal life from the salt water in any considerable quantity. Except for those groups living along the coast and in the vicinity of the lakes and rivers, there was little opportunity for the people of the interior to obtain fresh water animal life. While no doubt the ancestors of many of the local tribes had used wild game liberally, the rigid restriction imposed by the controlling governments has largely eliminated game as a source of food for the present generation. We have accordingly conditions which in some respects resemble those of several of the other large continents.

On the basis of the chemical analysis of the foods used by the various groups, particularly the mineral and activator content, there has been excellent correlation of the diets used by the various groups studied previously who had high immunity to dental caries.

Before undertaking the studies in Africa, I was impressed by my experience that no groups had yet been found building strong bodies and maintaining excellent health while depending entirely on plant foods. This accordingly constituted one of the important quests in both the South Sea Islands and the recent African studies.

In addition to a liberal source of minerals for body building and repair, it has been apparent that all groups successful in maintaining a high immunity to dental caries have been using some special animal products of high quality. This seems to have been the essential source of fat-soluble activators or vitamins.

For the people of the high Alps, the dairy products were produced almost entirely on rapidly growing grass fresh or stored, which assured milk of exceptionally high vitamin content as ascertained by a chemical analysis of the vitamin content of the butter for the past four years. This is part of the study that I have been carrying forward for the past eight years on the variation of vitamin content of dairy products for the same place at different times of the year and for different places at the same time. An additional liberal source of phosphorus is provided for the people in these high Alpine valleys in the entire rye products.

For the people of the Outer Hebrides, the fat-soluble activators were provided liberally in the diet consisting largely of fish and other sea foods; including the use of cod livers mixed with oatmeal baked in cod's head.

For the Eskimos of western Alaska, the fat-soluble activators were provided liberally in the organs of the animals, chiefly from the sea, and by the oil of the seal, whale and other animals.

As for the Indians of the far north in Canada, depending on the animals of the chase almost entirely for nutrition, I found them eating very largely of the animal organs, heart, liver, kidney and brain and other special tissues, the muscle meat being secondary.

For the people of the South Sea Islands, the animal life of the sea provided a liberal source of the fat-sol-

uble activators as well as the minerals.

My studies in Africa were directed particularly toward the possible sources of fat-soluble activators or vitamins. Every group found to have a high immunity to dental caries was using one or more of the sources of fat-soluble activators of the groups previously studied. The cattle tribes depended largely, and some almost entirely, on milk, blood and meat of their herds. The cows were milked twice a day, morning and evening. The steers were bled at regular intervals. In a few cattle-raising tribes, these foods were supplemented with roots, chiefly sweet potatoes and, in some districts, with bananas or cereals.

For the people living in the vicinity of Lake Victoria and other lakes, and the large rivers, the fresh water fish were used liberally. The abundance of the fish in the upper Nile makes this an important source of food for nearby tribes. For example, a firm on Lake Albert has a contract for supplying 1 ton of dried fish a day to one of the Belgian Congo mines. The famous Nile perch grows to an enormous size, sometimes to over 150 pounds. For these people, the fish provide a very liberal source of the fat-soluble activators, since these native tribes eat practically all of the organs as well as the muscle meat.

It is of interest that, in all these studies, the stature of the members of the tribes seems to be related to the source of fat-soluble activators used. Of the three sources of fat-soluble activators so far found in use; namely, dairy products, animal life of the sea and the organs of land animals, the tribes using an excellent quality of dairy products liberally have proved to be the tallest. The tribes using the organs of animals were conspicuously resistant to climatic hardships and fatigue.

The evidence gathered in the South Sea Islands indicated that among the cannibalistic tribes, the liver was the most sought for portion, and indeed much evidence is available that, for the cannibals, the liver provided very important essential factors for life. This apparently constituted an important compelling force to the eating of prisoners.

Of the various tribes met in eastern and central Africa, the tallest were the Neurs. The men frequently exceeded 7 feet in height. I was particularly interested in a study of their diet and found that, in addition to maintaining herds of cattle and living on milk, blood and meat from that source, they were skilful hunters on the Nile and its tributaries. They hold in very high esteem the liver of animals. Their interpretation of life is that each man has a soul which controls and determines his personality; his soul resides in his liver and the means by which his soul can be nourished is entirely by eating liver. The liver is held to be too sacred to be touched with human hands and must be eaten without such contact.

In my studies of the Indians of the far north of Canada, I asked an old Indian how they obtained their wonderful wisdom regarding foods and the art of living. He told me that a great Power taught the Indians to watch the animals to see what they ate.

I found the native tribes in Africa using the same principle. When I inquired why they ate the organs of the animals, particularly the liver, they reported that when a lion, the strongest of the beasts for its size, kills a zebra or another animal, it starts by eating at the flank and goes directly to the liver as the first of the organs to be eaten.

On the basis of the fat-soluble activators or vitamin content of the foods used, I found that those groups using at least two of the three principal vitamin sources had the highest immunity to dental caries. Those using the lowest amount of the

fat-soluble activators had the greatest amount of dental caries. On this basis, namely, the fat-soluble activator content of the diet, those groups using the fat-soluble activators in liberal quantity had not more than 0.5 per cent of the teeth attacked by dental caries; while those using fat-soluble activators less liberally had up to 12 per cent of the teeth attacked by dental caries. All groups having a liberal supply of minerals, particularly phosphorus, and a liberal supply of fat-soluble activators, had 100 per cent immunity to dental caries.

This seems to provide means for a direct application of these data to the problems of the prevention of dental caries and the prevention of dental arch and facial deformities among the people of modern civilization.

Large numbers of samples of foods were obtained for chemical analysis and brought to my laboratories.

SUMMARY

1. These studies of native races in eastern and central Africa reveal in general a high immunity to dental caries, approximating 100 per cent for those tribes who are living on their best native foods in accordance with the accumulated wisdom of their tribes.

2. The isolation of the tribes studied in eastern and central Africa was more complete than for most of the primitive racial stocks previously reported.

3. Very few groups were found in central Africa who had low immunity to dental caries.

4. As studies were made progressively down the Nile from near its source to Cairo, there was a marked lowering of the immunity level for dental caries at the point of contact with modern civilization and its foods at Khartoum. There was a progressive increase to and including Cairo.

5. The only factor that was found to have changed at the point where immunity to caries was lessened was a change in foods used.

6. The characteristics of the foods of those groups who had high immunity to caries were a relatively high level of the fat-soluble activators or vitamins and a high level of minerals, including phosphorus.

7. The characteristics of the foods used by the groups with a low immunity to dental caries, when compared with the foods of the high immunity group, was a marked reduction in the sources of fat-soluble activators and in the amount of available minerals, particularly phosphorus.

8. Practically no divergence from the tribal pattern of dental arch and facial form as characterized by irregularity of the teeth was found in the groups using foods supplying liberally fat-soluble activators and minerals.

9. All dental arches were broad and normally curved and had quite normal intermaxillary relationships.

10. In the groups using foods low in fat-soluble activators or vitamins, if the mothers were using this diet during gestation and lactation and if the children had used it during the growth period, many cases were found of irregularities of the dental arches and divergencies from normal facial form.

11. The physical excellence of the groups using a dietary that was rich in fat-soluble activators and high in minerals greatly exceeded that of the groups living on less efficient foods.

12. The data obtained from the study of these African groups correspond in essential characteristics with those obtained on the people of Switzerland and of the Outer Hebrides, the Eskimos of Alaska, the Indians of the far north of Canada, the Melanesians of the Western Pacific archipelagos, the Polynesians of

the Eastern and Central Pacific archipelagos and the past and present Indians of Florida.

This is a preliminary report. More detailed information will be made available when the chemical analyses are completed on the sample of foods collected.

8926 Euclid Avenue.

RESECTION OF MANDIBLE: REPORT OF CASE

By GEORGE F. SEEMAN, D.D.S., Nashville, Tenn.

HISTORY.—A negro, aged 24, poorly developed and poorly nourished, came to the Nashville General Hospital with a swelling of the left side of the face, with from six to eight sinuses. Wide incisions were made and curettement and removal of diseased bone were carried out after the patient had been in hospital several weeks. This relieved him for a month, when he again came in for treatment. Swelling and drainage, with edema, had continued for a period of ten years. There was no history of diabetes, insanity or tuberculosis in the family. The Wassermann reaction was negative.

Diagnosis.—A roentgen-ray examination revealed a tumor, probably a benign odontoma, involving practically all of the left side of the mandible, with evidence of osteomyelitis. After numerous external incisions, internal drainage and removal of sequestra, a diagnosis was made of chronic osteomyelitis of the jaw, which was hopelessly diseased. Resection of a portion of the mandible was advised after consultation with the staff general surgeon. A series of roentgenograms taken over a period of several years revealed no extension of the original area.

Treatment.—Resection of the jaw was carried out, with the following technic: Instead of an incision carried down the median line and backward to a point under the lobe of the ear, the technic originally employed by G. V. Black, and later improved and modified by Robert H. Ivy, for circumferential wiring, was employed. Two small incisions were made through the skin at the lower border of the mandible, one anteriorly and one posteriorly to the diseased area, as shown in Figure 1. With a small antrum trocar and cannula, as

Fig. 1.—Appearance of tumor in roentgenogram.

described in "Fractures of the Jaws," by Ivy and Curtis for circumferential wiring of edentulous jaws, a Gigli saw was passed around the jaw anteriorly and posteriorly to the segment to be removed. After internal resection of the mucoperiosteum, a piece of bone was removed 6 cm. long and from 2 to 4 cm. in diameter.

Figure 2 is a roentgenogram taken after resection.

The patient was given cod liver oil. He

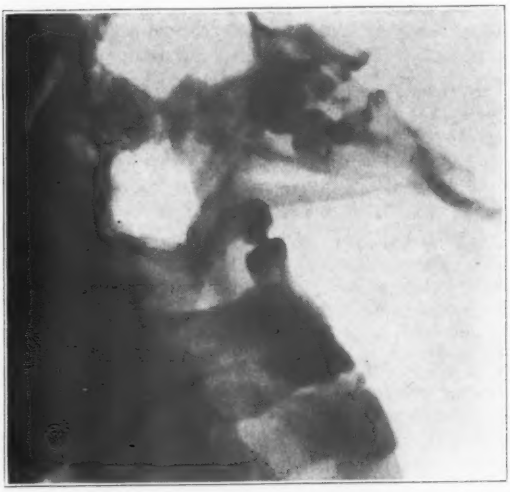


Fig. 2.—Appearance after resection.

Fig. 3.—Appearance of patient after recovery.

is able to open his mouth and is feeling well. All drainage and swelling have subsided. Figures 3-4 show the patient after complete recovery.

440 Doctors Building.

Fig. 4.—Appearance of patient after recovery.

The Journal of the American Dental Association

212 East Superior St., Chicago, Ill.

C. N. JOHNSON, Editor

Published by the American Dental Association

All expressions of opinions and all statements of supposed facts are published on the authority of the writer over whose signature they appear, and are not to be regarded as expressing the views of the American Dental Association, unless such statements or opinions have been adopted by the Association.

Communications intended for publication in the scientific or literary pages of THE JOURNAL should be addressed to the Editor. All advertising or business matter should be sent to the Business Manager.

Subscription is included in the annual membership dues. The subscription rate to non-members is $5.00 a year in advance, this rate applying to both domestic and foreign subscribers. All foreign subscriptions are to be paid in United States money.

Editorials

A MOST SATISFACTORY DENTAL LAW

What seems to us a very near approach to an ideal dental law is embodied in the New South Wales Dental Act, which came in force in 1934. Space will not permit us to reproduce the entire law, but we are hereby privileged to outline some of the most salient features. This is made possible through the courtesy of Sir Harry Moxham, president of the Australian Dental Association, and Dean A. J. Arnott, of the Sydney University, who visited America during the past winter. We are indebted to these gentlemen for the following:

This Dental Act was framed from the dental laws of most of the modern countries, and altered to suit local requirements. The credit must necessarily belong to all those countries which have done the pioneering work. We have just come along later and improved the conditions as we found them.

It starts off by consolidating all previous dental legislation into one act, deleting and adding to where necessary. It begins by defining the practice of dentistry and what constitutes a dentist, and sets out the penalties imposed for the illegal practice of dentistry.

The practice of dentistry is defined as:

Any operation on the jaws, teeth or surrounding tissues, the replacement of lost

teeth and supporting structures by artificial dentures and appliances, the repair of such artificial appliances; the administration and use of anesthetics, both local and general; the taking of x-rays of the oral tissues, and the giving of opinions, advice and diagnosis.

A dentist must be a registered person, and if he fails to keep himself registered, he ceases to be a dentist and is liable for prosecution if he practices as such. All persons in future wishing to register as dentists must attend the University of Sydney Dental School, or some such institution of a standard equal to the University of Sydney, and after qualification apply before the dental board for registration, which application must include statutory evidence of undoubted good character.

Among the clauses of the act will be found:

1. No person is allowed to practice dentistry under any but his own name and must be in attendance at the regular hours of practice.

2. A dentist may specialize in any branch of dentistry, provided the dental board approve, which is not unreasonably withheld, but no person may specialize in more than one branch of dentistry, and his practice must be confined to that branch alone.

3. No dentist is allowed to train or take a pupil or an apprentice for any branch of dentistry; this particularly applies to dental mechanics, provision being made for those wishing to become mechanics or technicians to study at a proper institution the subjects necessary for their vocation.

4. No dentist is allowed to place on his metal plate any designation or letters but those approved and recorded by the dental board. The size of the metal plate is in accord with the regulations, as are also the headings on stationery, letters, envelopes, etc. No notice cards are allowed to be placed in hotels, pharmacy shops, departmental stores, or in any place frequented by the public.

5. A dentist is not allowed to advertise in any manner whatsoever; neither by the daily press, circulars, wireless, show-cases, dodgers, public meetings, electric nor neon signs, nor in any other manner. In fact, his name must not appear in public in association with his profession, exception being telephone and city directories, congress and convention meetings.

6. A dentist holding a position associated with companies, institutions, clinics, departmental stores and the like, is required to see that his position is not advertised by himself or his employer in any manner whatsoever. It is also not permitted for any dentist to allow his name to be placed on any article, nostrum or manufactured product used in dentistry.

7. The dental board is constituted by four dentists elected by the dental profession tri-annually, the dean of the faculty of dentistry, the president of the Dental Hospital of Sydney (which is the training school associated with the University of Sydney), a member of the medical profession appointed by the government, and a representative of the legal profession appointed by the government. The registrar of the dental board is appointed by the government, and carries out all duties pertaining to the policing of the act, which includes the enforcement of the regulations dealing with the practice of dentistry, as well as protecting the public against unqualified persons. Officers are appointed in different areas throughout the state for the purpose of investigating and reporting to the dental board any breaches of the dental act.

8. Each dentist must pay annually a registration fee of not more than £2 ($10). A portion of this fee establishes a fund for free education at the university dental

school for the children of poor people. Another portion assists in the maintenance of the research department, and a further portion is used in supporting the Dental Health Education Department of the Australian Dental Association.

9. To enable the dental board to control the status of dentistry, both professionally and socially, the president and members of the board can, when required, constitute themselves into a royal commission, having all powers of the supreme court, the president of the board acting as a supreme court judge. The board then sits in open court. The object of this is to maintain control over dentists who may be guilty of misconduct, not only in a professional respect, but towards society generally: that is to say, against addicts, felons, drunkards and all abusers of society, which, in the eyes of the board, would render the accused as not a fit and proper person to practice dentistry.

10. The act opens the door to all graduates from outside Australia, but requires that the standard of education received by foreign applicants must be in line with requirements of the dental school at the University of Sydney.

11. No state board examination is required for registration.

12. Medical practitioners practicing in any branch of dentistry must apply for registration to the dental board.

13. No medical practitioner without being registered by the dental board is allowed to perform any dental operation in any town or village wherein is located a practicing dentist.

14. The taking of x-rays of the teeth or jaws is defined as practicing dentistry, and no dentist is allowed, under the regulations, to place on his metal plate or stationery, etc., that he takes x-rays, unless he limits his practice to that class of dentistry, and receives permission from the dental board.

It will be seen that certain of these provisions are more stringent than those that prevail in America, and it is doubtful that they could be enacted in this country, but the general purport of the act is to strengthen the ethical status of the profession and to safeguard the public. We commend this measure as a whole, and ask our readers to study it very carefully.

THE YOUNG FELLOWS

We have sometimes heard remarks made on the part of some of the older men in the profession in which the term "the young fellows" has been used with an inflection that indicated a certain amount of deprecation and even of derision. We have actually heard men say "The young fellows think they know it all," and we have always been sorry that such a remark should be made.

There is usually an implication in it that is not quite wholesome, and not quite creditable to the man who makes it.

It may be true that the exuberance of youth frequently leads a young man into saying and doing things that are foolish. Immaturity and inexperience carry with them a handicap that cannot be ignored, and it requires a certain amount of ripening before a young man can function with judgment and safety. But the constant repetition of the phrase "the young fellows" in a derogatory sense is not conducive to progress, and not in accordance with the best ethics or in fact with the truth itself.

These same young fellows are frequently capable of doing very wonderful things, particularly in the field of technical achievement. They are often endowed with a very astonishing skill, the fruits of which are needed in the furtherance of advancement in our profession. And even aside from technical skill and to go farther afield in the realm of research, the alertness with which some of these young men grasp the scientific problems of the day and bring on them the fertility of their genius forms one of the most encouraging chapters in the development of dental science.

We cannot afford in any way to minimize the ambition, the ability or the influence of the younger men. Sometimes, they do need direction; in fact, they usually need it very much, otherwise they would break loose and go off on a tangent on some hair-brained scheme that must inevitably lead to their discomfiture and the discomfiture of others. But better far that they be encouraged to venture even though they may sometimes go beyond their depths than that they be constantly held back and admonished not to try to swim at all.

It is true that we sometimes see in young men a tendency toward arrogance and superciliousness; in other words, they become what in the vernacular is called "fresh," which, by the way, is a very good word when applied to the case in hand. We all know the type, and in truth it is a very trying type, but there is another kind of young man that should claim our earnest consideration and our most solicitous cooperation and encouragement.

This is the timid young man who is inclined to retreat unto himself in the presence of his elders, but who, in many cases, is

bursting to give expression to his longings and his enthusiasm, and who sorely needs the stimulus of older and more mature minds. This is the type that should call forth our heartiest approbation and good will. Nothing that we can do in the way of encouragement for this kind of boy is ever amiss. We shall not spoil him by a word of praise or an approving pat on the back. We shall hearten him and add to his incentive to do better things. An old adage has it that "no man ever died of too much encouragement," and neither, be it said, is he ever seriously injured. This is particularly true as it applies to the case in hand.

Of course, we have all seen examples of a young man losing his balance and becoming puffed up over his own importance. In truth, there is a certain kind of boy who requires a different treatment from that just indicated. He needs a paddle instead of a parachute and is an entirely different kind of boy. We hope to pay our respects to the latter type in the near future.

But that is another story.

PRACTICE IN PARAGRAPHS

This department is intended for busy readers. It aims to tell a vivid story in a few words. Items should be of a practical character, and free from padding—not more than a paragraph or two. We exact no limit, but two hundred words can tell most of these stories. Send in your ideas; they will be welcome.

Competitor—Take with a grain of salt what some say against your competitor. An unpaid bill may be the cause of the criticism.—*C. C. Norris, Oshkosh, Wis.*

Taking the Bite—In taking the bite for an upper denture, place an old bur across in the region of the first molar. Have the patient put the tongue over the bur and bite.—*C. C. Norris, Oshkosh, Wis.*

Accent on Cleanliness—Do not have any instruments on the operating tray when your patient enters the operating room. Allow him to see either your assistant or you get a clean napkin for the tray, probe, mouth mirror, and air syringe; then he will know they are all clean and sterile.—*Henry Stevens, Hart, Mich.*

Indications for General Anesthesia—There are patients who have a "dread" of a needle and a prejudice against a local anesthetic. Some are extremely nervous and scream and groan when touched. This type of patient is not a good subject for local anesthesia; nor are children. General anesthesia is the anesthesia of choice for such patients.—*James L. Zemsky, 147 Fourth Ave., New York City.*

Retracting the Cheek—In the preparation and filling of buccal cavities in molars and bicuspids, it is sometimes difficult to retract the cheek and at the same time get enough of a view to work properly. If the bend at the neck of an ordinary mouth mirror is reversed so that the position of the metal and silver sides is reversed, retraction of the cheek will be permitted and at the same time the operator will be enabled to see the field of operation clearly.—*J. Reicherter, Baldwin, N. Y.*

Squaring for Silicates—With advised patients, the gradual deterioration of silicates is expected, but their rolling out of the cavity entirely is unwarranted. A marble rolls because it is round. A cube is staple because it is not round. A squared cavity preparation prevents rolling and favors retention. Fillings do not roll out because they are square and can't. Underrating silicates is unfair when cavity preparation is half done. No filling is better than the cavity containing it.—*Herbert Ely Williams, Red Bank, N. J.*

Toothbrush Instructions—Patients have been the recipients of various home brushing instructions. The lingual surfaces of all teeth, especially of the lower incisors and the buccal surfaces of the molar region of the upper, are more susceptible to the deposits of glandular contents. Wherever tartar deposits form faster, brushing is needed more. The rotary up-brushing motion of lower teeth and the downward motion of the upper teeth are standardized movements, but the application should be confined more to those areas adjacent to gland ducts, which need it most.—*Herbert Ely Williams, Red Bank, N. J.*

Preliminary Educational Advice—Educational advice must predominate at a patient's initial dental visit. Send them home to digest and assimilate your advice. If you have something good, they will not run away. Eagerness to fill something with something else at once is decidedly a dental instinct. It robs the enterprise of its importance. The best filling materials are gold foils, enthusiasm and personality. Personality is of two kinds: one the fair weather variety, the other when the going is rough. Personality makes all sorts of good fillings seem better and other patients will wish to learn whether your boosters have told the truth about you.—*Herbert Ely Williams, Red Bank, N. J.*

Typewriting Vs. Handwriting—A dentist who was formerly a railroad telegrapher wrote a railroad superintendent, who was also a former telegrapher, concerning a railroad employe. The telegrapher's handwriting is often extremely characteristic owing to speed in receiving messages. The letter was not particularly formal yet dignified. Informality and familiarity are not synonyms. The reply received contained the words, "Boy, oh boy, your telegrapher's hand is still working fine." A personal contact with the railroad superintendent would be mellowed and much easier than if a formal, hard boiled, typewritten letter had been sent. A touch of human yet sincere approach often takes one farther than the overserious formalities of the too serious minded person.—*Herbert Ely Williams, Red Bank, N. J.*

Securing Exact Centric Occlusion—By the exercise of a little knowledge of psychology and anatomy, it is possible to secure exact centric occlusion, and to know positively that you have done so. Place the index fingers on the patient's temples, allowing the third and fourth fingers to drop in back of the ramus just above the angle of the mandible and direct the patient to try to prevent you from drawing the mandible forward, then make slight forward pressure while pretending that you are exerting great force. The mandible will immediately retract into exact centric relation, and you will know that it has done so when you feel the temporal muscles become tense under your index fingers, because these muscles cannot become tense while the mandible is in any other position than exact centric occlusion.—*A. B. French, 1003 Peoples East End Bldg., Pittsburgh, Pa.*

Care of Spare Denture—The troublesome problem of a patient's alternating between an old, usually comfortable, but ill-fitting, denture and the new one is avoided by asking that the old denture be left at the office at the time that the new denture is placed. The old denture is cleaned carefully with a mild antiseptic and placed in a wide-mouthed fruit jar in an unstarched wet cloth, and after from twenty-four to forty-eight hours, denture and jar are sterilized. The patient is shown the old denture and told the reason for sterilization; i.e., to kill micro-organisms and spores, and is asked to call for the old denture two weeks later, when it is suggested that the denture be kept thus in a jar for use in an emergency. This discourages alternation and keeps the denture properly sterilized, and as moist dentures do not dry out and crack, the spare denture is ready for service in an emergency.—*Sidney D. Dalrymple, Medical Bldg., Havre, Mont.*

Preventing Tooth Decay—A short summary of my method of preventing tooth decay, and a curative method of checking decay that has started on the deciduous teeth that have not reached too close to the pulp is as follows: It was about eight years or more ago when this method of treating these cases occurred to me. I made my first tests by removing a labial inlay from my upper left cuspid tooth, then I removed the cement that was adherent to the cavity and exposed the dentin. I applied to the cavity ammoniated nitrate of silver for two minutes and then applied oil of cloves. This set the silver nitrate and the cavity became black. Every three or four months, I repeated the treatments. At the end of a year, I removed a contact filling from the same cuspid tooth and treated this cavity as I did the labial cavity. This tooth is still alive and not sensitive, nor has decay occurred. My experiments later on were on the labial surfaces of the lower right bicuspids, which I permitted to become decayed by removing enough dentin so that food would collect, and, of course, I did not brush these surfaces except by chance. In about a year, decay progressed enough to call a halt, and after application of the silver nitrate and clove oil three or four times a year, those cavities became immune to decay. These cavities are still open and any time at your leisure you may inspect them and also some of the teeth of children who are protected by this method.—*James E. Keefe, 104 S. Michigan Ave., Chicago, Ill.*

COUNCIL ON DENTAL THERAPEUTICS

ACCEPTED DENTAL REMEDIES

The following articles have been accepted as conforming to the rules of the Council on Dental Therapeutics of the American Dental Association. The Council wishes dentists to understand that the admission of an article does not imply a recommendation. A copy of the rules that govern the Council in the consideration of articles will be sent on request.

SAMUEL M. GORDON, *Secretary*

ANESTHETICS—LOCAL*

Novocain Solution 20% with Suprarenin 1:9000: Each cubic centimeter contains novocain, 0.2 gm.; suprarenin (as bitartrate), 0.00011 gm.; sodium bisulphite, not more than 0.005 gm.; distilled water to make 1 c.c.

This solution must be diluted before it is used. (One volume, for example, yields ten volumes of a novocain solution, 2%, with suprarenin 1:90,000.)

Novocain Solution 20% with Suprarenin 1:9000 in Ampules, 1.5 c.c.
Novocain Solution 20% with Suprarenin 1:9000 in Ampules, 5 c.c.

Novocain Solution 2% with Suprarenin 1:20,000: Each cubic centimeter contains novocain, 0.02 gm.; suprarenin (as bitartrate), 0.00005 gm.; sodium chloride, 0.002 gm.; potassium sulphate, 0.004 gm.; sodium bisulphite, not more than 0.0015 gm.; distilled water to make 1 c.c.

Novocain Solution 2% with Suprarenin 1:20,000 in Ampules, 1 c.c.
Novocain Solution 2% with Suprarenin 1:20,000 in Ampules, 3 c.c.
Novocain Solution 2% with Suprarenin 1:20,000 in Ampules, 6 c.c.

Novocain Solution 2% with Suprarenin 1:50,000: Each cubic centimeter contains novocain, 0.02 gm.; suprarenin (as bitartrate), 0.00002 gm.; sodium chloride, 0.002 gm.; potassium sulphate, 0.004 gm.; sodium bisulphite, not more than 0.0015 gm.; distilled water to make 1 c.c.

Novocain Solution 2% with Suprarenin 1:50,000 in Ampules, 1 c.c.
Novocain Solution 2% with Suprarenin 1:50,000 in Ampules, 3 c.c.

Novocain Solution 1% with Suprarenin 1:50,000: Each cubic centimeter contains novocain, 0.01 gm.; suprarenin (as bitartrate), 0.00002 gm.; sodium chloride, 0.004 gm.; potassium sulphate, 0.004 gm.; sodium bisulphite, not more than 0.0015 gm.; distilled water to make 1 c.c.

Novocain Solution 1% with Suprarenin 1:50,000 in Ampules, 2 c.c.
Novocain Solution 1% with Suprarenin 1:50,000 in Ampules, 6 c.c.

Novocain (0.125 Gm.) and Suprarenin (0.125 Mg.) Hypodermic Tablets: Each tablet contains novocain, 0.125 gm.; suprarenin (as bitartrate), 0.000125 gm.; boric acid, 0.00652 gm., and acetone sodium bisulphite, not more than 0.00025 gm.

Novocain (0.1 Gm.) and Suprarenin (0.25 Mg.) Hypodermic Tablets: Each tablet contains novocain, 0.1 gm.; suprarenin (as bitartrate), 0.00025 gm.; boric acid, 0.00525 gm., and acetone sodium bisulphite, not more than 0.0002 gm.

Novocain (0.05 Gm.) and Suprarenin (0.083 Mg.) Hypodermic Tablets: Each tablet contains novocain, 0.05 gm.; suprarenin (as bitartrate), 0.000083 gm.; boric acid, 0.00275 gm., and acetone sodium bisulphite, not more than 0.0001 gm.

Novocain (0.02 Gm.) and Suprarenin (0.05 Mg.) Hypoder-

*A.D.R., 1935, p. 43.

mic Tablets: Each tablet contains novocain, 0.02 gm.; suprarenin (as bitartrate), 0.00005 gm.; boric acid, 0.00187 gm., and acetone sodium bisulphite, not more than 0.00004 gm.

Novocain (0.06 Gm.) and Suprarenin (0.06 Mg.) Hypodermic Tablets: Each tablet contains novocain, 0.06 gm.; suprarenin (as bitartrate), 0.00006 gm.; boric acid, 0.00357 gm., and acetone sodium bisulphite, not more than 0.00012 gm.

Novocain (0.08 Gm.) and Suprarenin (0.06 Mg.) Hypodermic Tablets: Each tablet contains novocain, 0.08 gm.; suprarenin (as bitartrate), 0.00006 gm.; boric acid, 0.00473 gm., and acetone sodium bisulphite, not more than 0.00016 gm.

Novocain (0.02 Gm.) and Suprarenin (0.02 Mg.) Hypodermic Tablets: Each tablet contains novocain, 0.02 gm.; suprarenin (as bitartrate), 0.00002 gm.; boric acid, 0.001924 gm., and acetone sodium bisulphite, not more than 0.00004 gm.

Novocain (0.01 Gm.) and Suprarenin (0.0002 Gm.) Pluglets: Each pluglet contains novocain, 0.01 gm.; suprarenin (as bitartrate), 0.0002 gm., and acetone sodium bisulphite, not more than 0.00002 gm.

Manufactured by Winthrop Chemical Company, Inc., New York City.

DENTIFRICES*

Williams' Dental Powder.—Composition: Each 100 gm. is stated to contain: calcium carbonate (Sturge No. 130), 85 gm.; castile soap, 12.5 gm.; saccharin, 0.1 gm.; flavor, 2.4 gm.

Abrasiveness: 4.3 mg. per thousand revolutions (John & E. Sturge, Ltd., instrument).

Manufactured and distributed by the J. B. Williams Company, Glastonbury, Conn. No U. S. patent or trademark.

ARSENIC COMPOUNDS†

Mapharsen.—The hemialcoholate of 3-amino-4-hydroxy phenyl-arsine oxide hydrochloride.—$HCl.(NH_2)C_6H_3(OH)AsO.1/2C_2H_5OH$. It contains approximately 29 per cent of trivalent arsenic.

PROPERTIES: Mapharsen occurs as a white, amorphous, odorless powder. It is soluble in water, alcohols, acids, alkalis and alkali carbonates. The aqueous solution is acid to methyl red, but alkaline to congo red.

ACTIONS AND USES: Mapharsen is proposed principally for the treatment of syphilis. It is said to exhibit a relatively constant parasiticidal value. Reactions following the use of mapharsen have on the whole been less severe than those observed after the use of arsphenamine or neo-arsphenamine in the treatment of syphilis. It is claimed to affect Vincent's infection favorably and quickly. It is directly and immediately spirocheticidal and therefore suitable for local application. After such application the spirochetes and fusiform bacilli disappear, with healing of the lesions.

DOSAGE: Applied locally as powder or in solution. Sixty milligrams is said to be sufficient for a single treatment.

Manufactured by Parke, Davis & Co., Detroit, Mich. U. S. patent applied for. U. S. trademark 299,173.

Ampoules Mapharsen 0.04 Gm.: Each contains mapharsen, 0.04 gm., anhydrous sodium carbonate, 0.008 gm., and anhydrous sucrose, 0.152 gm.

Ampoules Mapharsen 0.06 Gm.: Each contains mapharsen, 0.06 gm., anhydrous sodium carbonate, 0.012 gm., and anhydrous sucrose, 0.228 gm.

Other tests of identity, purity and assay appear in the *Journal of the American Medical Association*, Jan. 18, 1936, pp. 106-214.

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*A.D.R., 1935, p. 91.

†A.D.R., 1935, p. 50.

BŌST TOOTH PASTE—NOT ACCEPTABLE FOR A.D.R.

The Council has authorized publication of the following report.

SAMUEL M. GORDON, *Secretary*

Bōst Tooth Paste, put out by Bost, Inc., Manufacturing Chemists, New York City, is stated to be "The New and Original Scientific Formula of Dr. Wm. Dale Bost, P.D., Ph.C."

It is advertised extensively to the laity and the profession as "The Smoker's Friend." One reads in a certain piece of advertising:

Dr. Bost's formula—probably the century's most progressive contribution to the science of oral hygiene—is the result of many years of research and experiment. His long labors were justified because countless numbers of smokers today are putting their faith in BŌST and, as a result, are putting new beauty into their smiles. . . .

Concluding his research, Dr. Bost discovered by exhaustive tests that he had been completely successful in producing:

(1) A tooth paste which would readily remove the stain of tobacco, or any other organic substance, and even many inorganic stains.

(2) A pure, wholesome tooth paste, free from any injurious ingredients whatever, beneficial to gums and membranes.

(3) A counteractant for mouth acids and a breath sweetener—an ideal mouth cleanser.

Dr. Bost's tooth paste is not only a new discovery, but a notable one, it has all the beneficial effects of the best tooth pastes of the past, with the new merit peculiar to itself, that it will quickly remove tobacco and other subborn stains.

To prove this claim, one is urged to "Make this startling test!"

Blow tobacco smoke through your handkerchief. It leaves a brown stain. Cover stain liberally with Bōst Tooth Paste, brush it briskly and—The stain disappears!

As an added attraction, Bōst Tooth Paste is also reputed to be beneficial to the gums, as well as for children's use, for "massaging the gums with Bōst Tooth Paste is *very beneficial,* making them firm and healthy," and we should "Remember, Bōst Tooth Paste is just as healthful and beneficial for children as for adults."

To make the picture complete, this final, unanswerable argument in favor of using Bōst Tooth Paste is presented: "Well, don't be a dodo—everybody's using Bost because it's the thing to do."

What does this "new and original scientific formula" contain? In 1931, an inquiry was directed to the firm, asking whether the composition of Bōst was secret, and, if not, that a qualitative and quantitative statement of composition be sent to the Council. In reply, the Council was informed that the formula was in the process of being patented and that certain information pertaining to the formula must not be made public until the patent was issued, and a qualitative statement of composition was sent as follows:

English precipitated chalk	Castile soap
Sodium chloride	Glycerine
Magnesium carbonate	Magnesium hydrate
Starch (dextronized)	Sweetened with saccharin

This does not represent a full statement of composition, for qualitative tests made in the A.D.A. Bureau of Chemistry indicate the presence of some oxidizing agent.

There is nothing in the foregoing qualitative statement of composition that would make Bōst Tooth Paste superior to, if equal to, any other soap-containing tooth paste on the market.

The firm informed the Council in the early part of 1931:

We are carefully reviewing our advertising copy and assure you that most careful and sincere effort will be exercised in re-writing of new advertising copy on package, printed circulars and other advertising mediums.

This is interesting in the light of a news item which appeared in *Printers' Ink* for

March 10, 1932, in which an officer of the firm stated that Bōst Tooth Paste was being sold to the public definitely on an appeal to fear. Readers of their advertising were warned: "Beware of Smoker's Teeth! Your Dentist will tell you tobacco stain precedes decay! Bōst Tooth Paste safely removes it." And again: "Bōst Tooth Paste removes stains that precede decay and does it safely."

No carefully controlled data have come to the attention of the Council which indicate that Bōst Tooth Paste removes tobacco stains from teeth more effectively than other soap-containing dentifrices on the market.

However, Bōst will remove not only tobacco stains, but " . . . the stain of . . . any other organic substance, and even many inorganic stains." Such a statement presupposes that all stains should be removed from the teeth, because they may give rise to caries. Reference to the literature would indicate that such is not always the case. Bibby has furnished an interesting report of a "brown plaque" associated with relative immunity to caries. This "brown plaque" is interesting because it is visible. After briefly reviewing the various views concerning the effects of mucin and bacteria on the teeth, Bibby rightfully concludes: "The condemnation of all muco-bacterial deposits is unjustifiable without more definite knowledge of their nature and effects."[1]

In view of the unconfirmed claims of the nature of these "plaques" and their effect on the incidence of dental caries, statements which infer that they are the cause of caries are misleading and unwarranted.

Caries, or tooth decay, as it is commonly called, is essentially a disease of childhood. Can it be that the caries of children's teeth was preceded by that dread condition, Smoker's Teeth? The answer is left to the Bōst advertising scientists.

Other unwarranted statements are made in the advertising. For instance, "A counteractant for mouth acids and a breath sweetener—an ideal mouth cleanser." This may be questioned in the light of the inability of induced substances to materially alter the acidity or alkalinity of the saliva.

In view of the foregoing, Bōst Tooth Paste is declared not acceptable for A.D.R.

After the foregoing report was scheduled for publication, the attention of the Council was directed to an item in *Reader's Digest* for January, 1936, on Bōst Tooth Paste which illustrates how the laity can secure for themselves enough information to explode the ridiculous claims that apparently have their origin in advertising offices:

Nothing to Bōst About—

The Kind of Advertisement We Nominate for Oblivion

A Recent Bōst toothpaste ad—and one which has appeared in substantially the same form at various times for over two years—invites us to "Try the Handkerchief Test." "Blow a big puff of your favorite smoke through a clean white handkerchief and note the tar stain (not nicotine) left behind. Now wet a toothbrush, squeeze on a half inch of Bōst and brush the stain away. A few quick strokes of the brush are sufficient . . . *No other toothpaste will remove that stain.*"*

Because of the bother of making such a test, readers may be grateful for a report of our own impartial experiment. We got a tube of Bōst and *tried* the handkerchief test. The "few quick strokes" simply were not "sufficient," but after considerable scrubbing, we did succeed in practically removing the stain. Then we tried the handkerchief test with half a dozen other toothpastes and one toothpowder, all of which worked just as well as Bōst did—or better. Incidentally, it was interesting to discover that plain soap and water worked best of all.

In commenting on this, one member of the Council wrote: "Collecting good controlled evidence is just a matter of using 'horse sense' in arranging the conditions of the experment. In this particular instance, the laity has collected it for the Council on Dental Therapeutics, the American Dental Association, and the public!"

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1. Bibby, B. G.: Study of Pigmented Dental Plaque, J. Dent. Res., 11:855 (Dec.) 1931.

*Italics ours.

BUREAU OF PUBLIC RELATIONS

A SURVEY OF CHILDREN'S DENTISTRY IN THE CURRICULUM*

THE data as compiled and submitted by Deans H. E. Friesell, Leroy M. S. Miner and A. R. McDowell, chairman of the College Committee, American Society for Promotion of Dentistry for Children, in 1932, showed the comparative progress in the teaching of children's dentistry from 1929 to 1932.[1] The committee states:

> In analyzing these results, we find that while only thirteen schools of the thirty-eight that sent in replies have a chair in children's dentistry, and only sixteen have a special children's clinic, thirty-six give clinical instruction in this subject, twenty-four have special lecture courses, and thirty-four give lectures in the subject.

The report of 1929 showed that twenty-nine schools reported and that only six had a chair in children's dentistry, eighteen gave special lectures and twenty-one gave lectures on children's dentistry.[1]

It was the object of the present committee to note the further progress made in the development of departments and lecture courses since 1932, as well as to determine, in a general way, the clinical and laboratory requirements.

Graduate and postgraduate work in children's dentistry and their requirements were also included in this survey.

The accompanying tables will show the comparative development and the curricular requirements in the schools of the United States and Canada.

Table 1 shows the faculty of forty-three schools that reported, naming the department heads and supervisors in children's dentistry. There are eighteen colleges having separate departments, seventeen having supervisors and six having no definite supervision.

Table 2 gives seventeen colleges having special clinics and twenty-four having minimal clinical requirements as recommended by the Curricular Survey Committee of the American Association of Dental Schools.[2] Thirteen schools have laboratory requirements and some others have laboratory instruction included in other courses, such as orthodontia and operative and prosthetic dentistry. Practically all of the extractions are supervised by the surgery department except five that are in the children's department, one in the operative department, two in the exodontia department and one in infirmary demonstrations. Only five required any root-canal therapy in clinical practice, varying from one to four cases. Most schools gave lectures on this subject.

Table 3 shows the classroom work or

*Report of the College Committee of the American Society for the Promotion of Dentistry for Children.

*No. 16, Tables 1, 2, 3, and 4 refers to Harvard University School of Dentistry rather than Howard University.

1. Internat. J. Orthodon., 18:208-212 (Feb.) 1932.

2. Table 10, Subjects of the Dental Curriculum and Number of Hours Recommended by Sub-committees. Report of Curriculum Survey Committee, American Association of Dental Schools, 1935, p. 375.

lectures in the different subjects. Eleven schools have no definite lecture program in children's dentistry, but it is referred to in other courses. Thirty-one other dental colleges have from five to 128 hours in lectures in children's dentistry.

Table 4 shows that three schools have graduate courses available, while seven have postgraduate instruction. The Atlanta-Southern Dental College states that plans are being made for the latter.

It will be noted that the requirements

TABLE NO. 1 CURRICULAR SURVEY IN CHILDREN'S DENTISTRY

SCHOOL	FACULTY					
	SEPARATE CHILDREN'S DEPARTMENT		NO DEPARTMENT--BUT SUPERVISOR			
	Name of Chairman	Percentage of time in school	Name of Supervisor	Title	% of Time in School in Children's Work	
1. U. of California			Mary Martin	Instructor	part time	
2. College of P. & S.			Harry A. True	Professor of Oper. Dent.	8 hrs. lec. per year 32 hrs. clinic year	
3. Uni. of So. Calif.	Florda E. Boeshore	Part time				
4. Georgetown University			Duran H. Thorn	Professor of Oper. Dent.	No Definite	
5. Howard University			R. W. Hendrick	Ass't. Prof. Preventive D.	Full time	
6. Atlanta-Southern	Walter T. McFall	Full time				
7. Northwestern	George Teuscher	Half time				
8. Chicago Col. of D.S.	Corvin G. Stine	Full time				
9. Uni. of Illinois	Klein Gerlach	Full time				
10. Uni. of Indiana			No special			
11. Uni. of Iowa	C. A. Drain	Full time				
12. Uni. of Louisville			No special	program		
13. Loyola University			A. P. Dangereau	Sup't. of Clinic	Half time	
14. Uni. of Maryland	Nathan B. Scheer	Full time				
15. Tufts College		No	Report			
16. Howard University			Paul K. Losch	Oper. Dent. Instructor	Full time	
17. Uni. of Michigan	Kenneth A. Easlick	Half time				
18. Uni. of Minnesota			H. C. Pittich	Instructor Oper. Dent.	Full time	
19. Uni. of Detroit	Walter C. McBride	Part time				
20. Kansas City Western	F. M. College	9 hours per week				
21. Washington Uni.	Harold Rice Smith	Full time				
22. St. Louis University	Genevieve Reifling	Part time				
23. Creighton University			Thomas Gardner	Instructor Oper. Dent.	Part time	
24. Nebraska University			John C. Brauer	Instructor Oper. Dent.	Full time	
25. New York University						
26. Columbia University	E. C. McBeath	Full time				
27. Uni. of Buffalo	A. W. Groh	Full time				
28. Western Reserve Uni.			No Special			
29. Ohio State Uni.			Wm. C. Graham	Prof. of Pray. Dent.	Part time	
30. Northern Pacific (Oregon)			E. B. Fason	Prof. of Orthodontia	Full time	
31. Uni. of Pittsburgh	C. W. Hagan	0.4 daily				
32. Temple University	T. D. Castro	6 hrs. per wk. lect. & teach.				
33. U. of Pennsylvania			A. B. Gabel	Prof. of Oper. Dent.	Full time	
34. U. of Tennessee			W. J. Templeton	Prof. of Oper. Dent.	Full time	
35. Meharry			No Special Program			
36. Texas Dental			V. Bloustein	Instructor Oper. Dent.	Full time	
37. Baylor University			M. M. Paule	Assoc. Prof. Oper. Dent.	Fourth time	
38. Virginia Dental			B. T. Knighton	Instructor Oper. Dent.	Fourth time	
39. Marquette University	George E. Hansen	Part time				
40. Uni. of Alberta	No organized effort					
41. McGill University	In other departments					
42. Dalhousie U., Canada			George E. Thomson	Prof. of Pray. Dent.	Part time	
43. Uni. of Montreal	J. L. Charpentier	Part time				
44. Uni. of Toronto	In other departments					

18 department heads (separate). 17 supervisions (as subdivisions of other departments).

of the institutions vary greatly, which is to be expected, owing to the transition definite progress has been made and that many schools are either establishing a

TABLE NO. 2 CURRICULAR REQUIREMENTS and ARRANGEMENTS

SCHOOL	Work in General or Special Clinic	Junior Clinical Requirements	Senior Clinic Requirements	LABORATORY				EXTRACTIONS SUPERVISED			
				Dental Anatomy	Cavity Prep.	Prosthetics	Other Requir.	Child's Dep't.	Surgery Dep't.	Other Dep't.	Root Canal Requirements
1. U. of California	General	90 hours 150 Points	90 hours 180 points	None	None	None	None		x		None
2. College of P. & S.	General	No definite	No definite	None	None	None	None			Operative	None
3. U. of So. California	General	2 Children	2 Children	Included in other departments					x		
4. Georgetown Uni.	General	None	None	Some dental anatomy					x		None
5. Howard University	General	96 hours	96 hours	None	None	None	None		x		None
6. Atlanta Southern	Special	72 hours	72 hours	6 hours	2 hours	6 hours	x	x			4 cases
7. Northwestern	Special	100 points	250 points	None	None	None	None		x		None
8. Chicago Col. of D.S.	General	1 child patient	1 child patient	None	None	None	None		x		?
9. Uni. of Illinois	Special	44 hours	44 hours	None	None	None	None		x		None
10. Uni. of Indiana	General	No definite	No definite	None	None	None	None		x		None
11. Uni. of Iowa	Special	300 points	380 points	None	None	None	None		x		?
12. Uni. of Louisville	General	No definite	No definite	None	None	None	None		x		None
13. Loyola University	General	No definite	No definite	None	None	None	None		x		None
14. Uni. of Maryland	Special	175 points	400 points	16 hours in all					x		4 cases
15. Tufts College		No report	No Report	No report	No report	No report	No Report	No Report	No report	No report	No report
16. Howard University	General	77 hours	77 hours	None	None	None	None		x		None
17. Uni. of Michigan	General	None	88 hours	8 Doc. molars		1 space Retain.			x		Seniors 1 cases
18. Uni. of Minnesota	Special	None	30 hours	None	None	None	None		x		M.D. Or Demonstrators
19. Uni. of Detroit	Special	None	90 hours			20 hours			x		None
20. Kansas City Western	General	288 hours	None	None	None	None	None		x		None
21. Washington Uni.	Special	96 hours	96 hours	None	None	None	None		x		None
22. St. Louis University	Special	None	None	8 space retainers				x			None
23. Creighton University	General	33	None	None	None	None	None		x		Very few
24. Nebraska University	General	No definite	No definite	30 hours		6	Space retain.		x		None
25. New York University	General	No definite					24 hrs. S. R.		x		None
26. Columbia University	Special	None	90 hours	None	None	None	None		x		None
27. Uni. of Buffalo	Special	None	None	19 hours					x		None
28. Western Reserve Uni.	General	6 hours	26 hours	Other departments					x		None
29. Ohio State Uni.	Both	None	None	None	None	None	None		x		None
30. Northern Pacific (Oregon)	General	None	None	None	None	None	None			Exodontia	None
31. Uni. of Pittsburgh	Special	64 points	160 points					x	x		Seniors 1 case
32. Temple University	Special	9 hours	90 hours	4 hours	6 hours	Varies	4-8 hr. R.C.Th.			Exodontia	2 cases
33. U. of Pennsylvania	Special	None	60 hours		6 hours	15 hrs. Sp. Ret.			x		None
34. U. of Tennessee	General	2 P. H.'s Week	2 P. H.'s Week	20 hours					x		Selected Cases
35. Meharry	General	None	None	None	None	None	None		?		None
36. Texas Dental	General	128 hours	75 hours	68 hours	30 hours	30 hours	18 hrs. R. G.	x			None
37. Baylor University	General	No definite	No definite	None	None	None	None		x		None
38. Virginia Dental	General	1 patient	1 patient	19 hours					x		None
39. Marquette University	General	36 hours	70 hours	None					x		None
40. Uni. of Alberta	General	None	None	None	None	None	None		?		None
41. McGill University	General	None	None	None	None	None	None		?		None
42. Dalhousie U. Canada	Both	None	None	None				x		Infir. Dmson.	None
43. Uni. of Montreal	Special	None	None	None							None
44. Uni. of Toronto	General	None	None	None	None	None	None		?		None

44 schools reporting. 17 have special children's clinics--remainder general clinics. 25 have minimal requirements--19 of which have minimum requirements as set up by Curriculum Survey Committee of the A. D. A. of Dental Schools. 13 schools have laboratory requirements--others have requirements interwoven with other courses, the majority of which are in Dental Anatomy.

Extractions

5 schools have extractions supervised in children's department.
2 in exodontia department.
1 in operative department.
1 by demonstrators only and the remainder in the surgery department.

Root Canal Therapy

5 schools have requirements in R.C. Therapy, from 1-4 cases.
2 schools do not state definitely as to this requirement, but say all necessary work must be done in the mouth.

of thought regarding the teaching in the field of pedodontia, and in view of curricular change. It is gratifying that very separate department or attaining definite supervision for the child.

Reports received from several of the

schools were of such nature that it was impossible to give accurately in a table the true perspective of their teaching.

search only. The teaching of children's dentistry is included in dental anatomy, operative dentistry and preventive den-

TABLE NO. 3 LECTURES IN CHILDREN'S DENTISTRY

SCHOOL	Embryology	Exam. of patient	Psychology	Cavity prep.	Space retainers	Prosthetics	Prophylaxis	Root Canal Therapy	Diagnosis and Prognosis	Office routine and business fundamentals	Other subjects	Comments
1. U. of California	x	x	x	x	x	x	x	x	x	x		Sub-div. Op. Dent. 32 hours lecture 8 lec. year
2. College of P. & S.				x								32 hours
3. Uni. of So. Calif.	x	x	x	x	x	x	x	x	x	x		lecture
4. Georgetown University		In other departments (In General)										
5. Howard University	x	x	No	x	x	x	x	x	General	General		
6. Atlanta Southern	x	x	x	x	x	x	x	x	x	x	x	96 hours lecture
7. Northwestern		x	x	x	x	x	x	x	x	x		22 hours
8. Chicago Col. of D.S.	x	x	x	Other depts.	Other depts.	Other depts.	x		x			18 hours
9. Uni. of Illinois		x	x	x	x	x	x	x	x	x		5 hrs. in 3rd year
10. Uni. of Indiana		In other departments (In General)										
11. Uni. of Iowa		x	x	x	x	x	x	x	x		x	
12. Uni. of Louisville		In other departments										16 lectures
13. Loyola University		In other departments (In General)										
14. Uni. of Maryland	x	x	x	x	x	x	x	x	x	x		18 hours lectures
15. Tuft's College			No report received									
16. Howard University	x	x	x	x	x	x	x	x	x			11 hours lectures
17. Uni. of Michigan	x	x	x	x	x	x	x	x	x	x	x	16 lectures
18. Uni. of Minnesota	x	x	x	x	x	x	x	x	x	x		19 lectures
19. Uni. of Detroit		x	x	x	x	x	x	x	x	x		17 lectures
20. Kansas City Western	x			x	x	x	x	x	x	x		18
21. Washington Uni.		x	x	x	x	x	x	x	x	x		
22. St. Louis University		x	x	x	x	x	x	x	x	x		1 lecture a week
23. Creighton University	x	x	x	x	x	x	x	x	x	x		16 lectures
24. Nebraska University	x	x	x	x	x	x	x	x	x	x		32 lectures
25. New York University		In other departments (General)										
26. Columbia University	x	x	x	x			x	x	x	x		10 lectures
27. Uni. of Buffalo	x	x	x	x	x	x	x	x	x	x		5 lectures
28. Western Reserve Uni.		In other departments (General)										
29. Ohio State Uni.	x	x		x	x		x	x	x	x		
30. Northern Pacific (Oregon)	x	x	x	x	x	x	x	x	x	x		10 lectures
31. Uni. of Pittsburgh		x	x	x	Other depts.	Other Depts.	x		x			16 lectures
32. Temple University	x	x	x	x	x	x	x	x	x	x	x	32 lectures
33. U. of Pennsylvania		x	x	x	x	x	x	x	x	x		
34. U. of Tennessee	x	x	x	x	x	x	x	x	x	x		32 hours
35. Meharry		No Special Program (General)										
36. Texas Dental		x	x	x	x	x	x	x	x			32 hours
37. Baylor University	x	x	x	x	x	x	x	x	x	x		32 hours
38. Virginia Dental		x	x	x	x		x	x				8 hours
39. Marquette University	x	x	x	x	x	x	x	0	x	x		128 hours
40. Uni. of Alberta		No organized effort (Taught in general way)										
41. McGill University	x	x	0	x	x	x	x	0	x	x		Indefinite
42. Dalhousie U., Canada	x	x	x	x	x	0	x	x	x	x		16
43. Uni. of Montreal		Covers all in general										12
44. Uni. of Toronto		In other departments (General)										*

11 Schools--no definite or specific lecture program in children's dentistry. 1 School--not reporting (Tuft's).
43 Schools--reporting in U. S. and Canada. Number of hours in lecture from five to one hundred twenty eight.

New York University writes: "We have a department of children's dentistry, but it was created for the purpose of re-

tistry." A laboratory course of twenty-four hours is also given to the seniors on space retainers. Eleven lectures are also

offered by Thaddeus P. Hyatt on pits and fissures of deciduous teeth and the first permanent molar.

Harvard University Dental School writes:

Information in addition to that covered in the questionnaire is made available to the senior students in conferences with Drs. Morse and Losch on the records of a special children's group. For the last seven years, a group of children have had the following observations recorded:

1. A check on the acid uric flora of the mouth six times a year.
2. Models made once a year.
3. X-rays (lateral jaw right) at time models are made (once a year).
4. Semi-annual check (routine) on blood, urine and saliva p_H.

TABLE NO. 4 GRADUATE and POST GRADUATE COURSES

	GRADUATE				POST GRADUATE			
SCHOOL	Pre-Requisite Courses	Time Required for M. S.	Name of Supervisor	Tuition	Length of Course	Name of Supervisor	Tuition	Concentrate
1. U. of California	D.D.S.				x	Mary Martin	x	Lecture, clinic
2. Atlanta Southern						Walter Moffall	(Plans are being made.)	
3. Northwestern	D.D.S.	3 quarters	George Teuscher	$610.00	Varies	George Teuscher	x	Lecture, clinic
4. Uni. of Illinois					4 Weeks	Elmie Ayrlach	$ 50.00	Practical
5. U. of Michigan	D.D.S.	2 se-mesters	E. English	$50 Res. $98 N.R.	1 hr.wk. Sem.	E. English	$ 17.50	Practical
6. U. of Minnesota					x	H. C. Vittich	x	x
7. Columbia Uni.					x	E. C. McBeath	x Sem. $250.00	
8. Ohio State	B.Sc. D.D.S.	3-5 quarters	No. C. Graham	x				Post Grad. Not Yet
9. U. of Pittsburgh	"No requests thus far."				Varies	U. W. Rowan	Varies	Practical, Theory

5. Semi-annual charting and examination of the mouth and teeth.

6. Detailed estimate of diet taken at three different times and reduced to one day's analysis.

7. Semi-annual physical examination as per charts furnished by the A. M. A. and a record of the general habits of hygiene and history of internal diseases. There are 102 active cases at present and no children over 3 are admitted. The records are individually correlated and a summary is furnished for students' use. The primary purpose of this endeavor is teaching the necessity of careful attention to children.

8. On entry to the clinic a prenatal, postnatal and family history is recorded.

Baylor University, College of Dentistry says: "At present, Children's Dentistry is taught in the operative department. Beginning with the fall of 1937, it is our intention to change our curriculum to conform with the recommendations of the Curriculum Survey Committee."

McGill University, Faculty of Dentistry, Montreal, states: "The teaching relative to the various aspects of children's dentistry is taken up in several departments, but it is believed that this work should be emphasized and should have a separate department."

University of Montreal, Faculty of Dentistry, states: "Children's Dentistry has just started as a special course and department."

Texas Dental College[3] contemplates the addition of a full-time instructor who will emphasize modification of the procedure followed in adult dentistry to apply to treatment of children.

Marquette University contemplates a larger program and the establishment of a special clinic room.

Nebraska and North Pacific College of Dentistry both plan to set up a minimal clinical requirement as recommended by the Curriculum Survey Committee.

The College of Physicians and Surgeons, Georgetown, and Indiana University are making plans for a separate chil-

3. Kenneth Wood Mayo has been designated as the professor of pedodontia in Texas Dental College and David Blonstein as clinical instructor.

dren's department in the near future.

The infirmary requirements in the children's clinic of the University of Pittsburgh Dental Department are given in Table 5.

TABLE 5.—INFIRMARY REQUIREMENTS IN CHILDREN'S CLINIC, UNIVERSITY OF PITTSBURGH

	Junior Year Points	Senior Year Points
Amalgam fillings	50	100
Cement	6	14
Cement bases	4	10
Prophylaxis treatment	4	10
Gold fillings	0	25
Deciduous root fillings	0	10

SCALE OF POINTS IN CHILDREN'S CLINIC

	Points
Prophylactic treatment	2
Deciduous root treatment	10
Cement base	2
Cement filling	2
Silicate filling	3
Amalgam filling 3b	10
Amalgam, other classes	3

An excess of required points in other work will be allowed to make up a reasonable deficit in gold points.

Atlanta Southern gives sixteen lectures a year to the freshmen and sophomores and thirty-two lectures to the juniors and seniors. This makes a total of ninety-six hours of lectures.

Marquette gives a series of 128 hours of lectures. The outline of the pedodontic course as taught at Marquette University has been published.[4]

Dentistry for children has received a remarkable impetus from the promotion and organization of the American Society for the Promotion of Dentistry for Children in 1928.

4. Internat. J. Orthodon., 20:829 (Aug.) 1934.

Methods in lecture and clinical procedures are tending toward standardization. There is a growing regard for the oral health of the child and, with the added stimulus within the classroom, children's dentistry will find its true place in modern dentistry.

The committee has no recommendations to offer, since such recommendations should come through the proper channels.

This report is presented in full appreciation of the material received from the deans and heads of departments of the various schools of dentistry.

Respectively submitted,
GUY S. MILLBERRY
FLOYDE E. HOGEBOOM
JOHN C. BRAUER, *Chairman.*

PUBLIC HEALTH DENTISTRY IN WASHINGTON AND TEXAS

A division of maternal and child hygiene has recently been established in the Washington State Department of Public Health in accordance with the provisions of the new Federal Social Security Act. The new division includes a bureau of dental hygiene. F. F. Smith has been appointed full-time supervisor of the new bureau.

Through funds made possible by the new Federal Social Security Act, the Texas State Department of Health has inaugurated several new divisions, including a dental division. It is the policy of John W. Brown, state health officer, that each of the divisions in the Department of Health shall be given equal importance. Thus, the position of the dental division is comparable in every respect to that of the other divisions. Edward Taylor has been appointed the new director of dental health.

Texas and Washington are the latest states to recognize the value of preventive dentistry in their public health program.

PRESENT PURPOSES AND POLICIES OF THE SUMMER ROUND-UP*

THE Summer Round-Up of the Children is the major health project of the National Congress of Parents and Teachers. Its object is to send children to the entering grades of school or kindergarten in good physical and mental condition. The Round-Up chairman should seek cooperation in planning with local medical and dental societies and public health organizations.

The objectives of the project include examination in the spring of all children who will enter school for the first time in the fall, correction of all remediable defects during the summer and a check-up in the fall to determine the condition of the children and the results of the project. More children are entering school every year as free as possible from defects and protected against disease as a result of this project.

When the Summer Round-Up was first begun, in 1925, the examinations were practically all made in groups, as it was believed that the stimulus of the groups was needed at that time. The present policy of the National Congress of Parents and Teachers is to advise parents wherever possible to take their children to the family physician and dentist for examination and treatment. Where this is not possible, group examinations arranged by the local unit are still advised. Where group examinations are made, the children are referred to physicians and dentists of the family's own choice for necessary corrections.

While this project concerns itself primarily with the children of the entering grades of school, where the Summer Round-Up has been carried on continuously over a number of years, there has been observed an increase in interest in periodic health examinations, which should be encouraged at all ages, but especially in early childhood.

*Prepared by the advisory committee for the Summer Round-Up.

INFORMATION FOR PHYSICIANS

In accordance with the expressed policy of the National Congress of Parents and Teachers, the present method of having children examined in group clinics is gradually being modified wherever possible, and it is suggested that the preschool physical examination be given in the office of the family doctor, or the doctor of the patient's choice if no established relationship exists with any one physician. This may be accomplished in one of several ways, which should be decided on by the county medical society, and in which all physicians in the community should participate in like manner, except specialists who do not work with children or physicians who do not choose to participate in the plan.

More detailed information about the Summer Round-Up than is given above may be had from the local parent-teacher's association. It is probably advisable to have a committee appointed by both the local parent-teacher's association and the local medical society, to settle details of the cooperative plan.

1. A definite hour, on a specific day of the week, the same for all physicians, might be designated for the performance of the preschool examinations.

2. Each physician might designate his own most suitable hour for these examinations in his own office.

3. Physicians might agree to make these examinations at the end of, or just before, their regular office hours.

4. Whatever time arrangement is made, physicians should agree to use the regularly designated examination blank, to fill it out completely and to cooperate in arrangements to deliver the blanks to the Summer Round-Up Committee in the most convenient manner.

5. A uniform and moderate fee should be decided on for examinations made at the specially designated hours; all examinations

at other times to be made at the physician's regular office fees for that particular type of work.

6. It has been customary, and presumably can be arranged locally, to examine gratis those children whose parents cannot afford the examination. Local social service organizations can assist in deciding who ought to pay. In some places, the local parent-teacher association has arranged payments to physicians for examinations of nonpay patients on a nominal fee basis.

7. Corrections should be advised, and should be made by the physician of the family's choice. Reports of corrections should be made in the most convenient manner, depending on local circumstances.

Group assembled "clinics" are being discouraged by the national congress as having outlived their usefulness in most places. It is recognized that, in some localities, the circumstances may be such that no other plan is feasible, or the medical society may prefer that method. Under such circumstances, great care should be exercised to provide a suitable, quiet, clean and private place for making the examinations, and to allow plenty of time and plenty of help for making them. The details of such "clinic" organization may be left to qualified public health nurses in the community, in cooperation with the local medical society committee.

SUMMER ROUND-UP DENTAL EXAMINATIONS

The dental examination of Summer Round-Up children is a most important, but usually a simple, procedure. Although the Round-Up is primarily and essentially a congress of parents and teachers project, its success is measured by the degree of cooperation received from the members of the health professions. Cooperation can best be secured from the local members of those professions by having them take an active part in the preparation of the Round-Up plans. Thus, the Round-Up chairman should, well in advance of the Round-Up, invite the local dental society to assist in the plans for the dental examination. In the event there is no local dental society, the local dentists should be requested to cooperate, acting as a unit. A thorough, mutual understanding of the purpose and procedure of any project is essential for its success. Therefore, a definite understanding should be had regarding the dates of the Round-Up; the type of examination; the assignment of children who have no family dentist; the examination fee to be charged those who can pay; the fee to be charged the near-indigent; the absence of a fee, when and where necessary; the plans for follow-up, and very definite plans for the correction of all defects found.

Dental examinations can best be made in the office of the private dentist, because the examiner has the proper equipment, instruments, lighting and hygienic facilities at hand. Also, the educational advantages offered by the examination in the office are most important. Often, this is the child's introduction to the dentist. This pleasant initial experience breaks down any fear the patient may have and prepares him for future visits should corrective work be necessary.

The dentists in certain communities, in order to expedite matters, prefer to make the examinations in the schools. In accepting this plan, it should be understood that, generally speaking, the examinations may not be so thorough as if made in the well-equipped private dental office.

INFORMATION FOR NURSES

The Summer Round-Up of the Children offers opportunity for the participation of public health nurses, and their cooperation is essential to its success. The initiation for Summer Round-Up plans is undertaken by the parent-teacher association. The nurse cooperates with all interested lay and medical groups.

There are four main functions of the nurse in this program:

1. Preliminary Arrangements.
   - (*a*) Cooperation with P.T.A. to develop plans.
   - (*b*) Cooperation in the plan for medical examination described in Section 3.

2. Case Finding.
   Nurses with the help of lay volunteers are needed to persuade families to use the Round-Up facilities. The methods are:
   (*a*) House to house canvass.
   (*b*) Preparing lists of preschool children, supplied by doctor, nurses, schools, Sunday schools, birth registration records.
   (*c*) Publicity through talks, newspaper articles and posters.
3. Assistance at Round-Up Clinic.
   (*a*) History taking.
   (*b*) Assisting physician with examination and recording findings.
   (*c*) Discussion of health problem with mother.
4. Home Follow-Up.
   This is peculiarly the nurse's part in the Round-Up. The nurse helps parents plan for indicated care. She refers health needs of other members of the family to the family physician or other medical service and she assists in family health teaching. Her findings and her services are recorded on the child's record.
5. Volunteer Service Through Lay Groups.
   This is valuable in
   (*a*) Preliminary arrangements, finance, publicity.
   (*b*) Case finding in cooperation with the nurse.
   (*c*) Transporting children otherwise unable to attend.
   (*d*) At special Round-Up, in acting as hostess, weighing and measuring.

SUGGESTED TITLE AND COPY FOR SECTION 6: COOPERATION

The general principles and information given above are intended to be helpful in the making of local plans for the Summer Round-Up. There can be no one national plan which will fit all local situations, but the general governing principles are the same everywhere. The National Congress of Parents and Teachers, with the advice of representatives of the American Medical Association, the American Dental Association and the National Organization for Public Health Nursing, offers these suggestions for the more satisfactory and efficient organization of Summer Round-Up examinations. Suggestions are invited from local participating groups, for consideration when revision of this information leaflet becomes desirable.

DR. PAMBY IS PLAINLY PERPLEXED*

Mrs. Paley was plainly perplexed.

She looked nervously at the little white notice in her hand, then glanced timidly at Dr. Pamby. "But, doctor," she said, "this notice from school says Donald has some decayed baby teeth and that I should"—

"From a school nurse," exploded Dr. Pamby. "What does a school nurse know about teeth?"

"But it isn't from a nurse," Mrs. Paley countered faintly, "it's signed by the school dentist."

"All the same," snorted the dentist, "young fellow has to make a showing, so he sends home notices willy-nilly. Donald is 7 years old, isn't he? In a couple of years, he will be losing those baby molars and getting his permanent teeth. Time enough then to start his dental work."

The perplexed mother looked quizzically at her family dentist. Her gaze traveled past his ruddy features and fo-

*Written as part of a nation-wide program for May Day-Child Health Day sponsored by the American Society for the Promotion of Dentistry for Children.

cused on a beautifully framed treatise hanging over his desk. Although she was unaware of it, she was looking at "The Dental Creed" written by Dr. C. N. Johnson several years ago. Curiously enough, her eyes picked out the following line:

"To wave a wand over the piteous, eager faces of deformed little children and transform them into comeliness of outline and the image of divinity."

Instinctively, the worried mother put her arm around young Donald's shoulder and drew him closer to her side.

"But if we don't have the decay removed now, won't the cavities get bigger and cause his teeth to ache? I don't want him ever to have toothache," she added, as a painful memory of her own childhood days flashed across her mind. Again her eyes sought the dental creed.

"To reach out a helping hand for the relief of pain and to willingly bring succor to the poor and needy."

"Fortunately," thought Mrs. Paley, "we aren't poor and we aren't needy, but Donald might suffer pain. I won't let Donald suffer pain if I can prevent it."

Dr. Pamby's voice cut sharply across Mrs. Paley's mental musings. "Don't worry about Donald's dental condition," he said reassuringly. "That's my job. I've taken care of your family's teeth for a good many years and I'm mighty proud of the work in your mouth and in your husband's mouth. Those two removable bridges of yours are beauties, if I do say so, and the lower partial denture that I made for your husband last fall is almost perfection itself. Time enough to take care of Donald's teeth when he gets older. Don't worry the child now."

Mrs. Paley's eyes dropped almost to the bottom of the handsomely framed dental creed.

"To attend to old and young alike with zealous care, and with an eye single to the demands of duty."

"I suppose so," said Mrs. Paley vaguely, "but it's all so confusing. Why should the schools send notices home to parents that scare the wits out of us?"

"Stuff and nonsense," replied Dr. Pamby. "Fads and fancies—schools didn't look after my teeth when I was a child, and they didn't look after your teeth when you were a child. Why should they bother now?"

Suddenly, timid Mrs. Paley straightened. "Thanks, doctor. If you don't think Donald's baby teeth need attention, we'll run along. Tell the doctor good-by, Donald."

Two weeks later, Dr. Pamby stood gazing out of his window at the slow stream of traffic passing his office. Suddenly, he stiffened. Mrs. Paley and Donald were leaving the office of Dr. Bakey across the street.

Dr. Pamby was plainly perplexed.

1935 REPORT OF THE MURRY AND LEONIE GUGGENHEIM DENTAL CLINIC

By JOHN OPPIE McCALL,* D.D.S., New York City

THE accompanying report presents the statistical record of the Guggenheim Dental Clinic for its fourth year of operation in the present building. The children from twenty public schools, eight day nurseries and twelve parochial schools, located in the vicinity of the clinic, are being treated. In addition, two special groups of children from the New York Hospital are receiving dental care. First consideration is given to the public schools, which are served over as great a radius as the present bus service (provided by the board of education) will permit.

It seems desirable again to emphasize the incidence of caries in preschool children. Continued study of this group reveals the probability that much of the caries found is casually related to hypoplastic (defective) enamel. Careful study of this condition in the deciduous dentition is obviously needed. Pending the results of such investigation, intensive local care of the teeth of all preschool children should be urged, since we continue to be confronted with a practical problem which may be summed up in the statement that more than 60 per cent of the children entering kindergarten have already suffered such extensive damage from caries that they are actually dental cripples as they step into the school room for the first time.

Attention is called to the high percentage of newly admitted children of all ages that have caries. This means that only 1.2 per cent are free from caries. Another figure which is closely related to this is the percentage of children originally free from caries who maintain that satisfactory condition as demonstrated on their recall visits. This figure drops to 0.5 per cent, indicating that true immunity to caries is almost nonexistent in the school children of New York City.

A sharp drop in recurrent caries is recorded this year. This is chiefly traceable to insistence on greater care in cavity preparation, especially with regard to correct extension of margins in fissures.

Experience with pulpotomy continues to be favorable. It is regarded as a standard procedure in properly selected cases.

In the oral surgery department, extractions continue to diminish. There is an increasing amount of pulp canal treatment, but no increase in apicoectomy (all infected cases have an apicoectomy performed when the root is filled). There is an increase in the number of gum flaps removed over erupting permanent molars, which is due to carrying out the clinic policy as regards prophylactic odontotomy.

The school for dental hygienists enrolled its largest class in September. Practice in oral prophylactic treatment is gained both at the clinic and at the Lenox Hill Hospital, as in the past. Experience at that hospital continues to indicate that dental hygiene service is an important adjunct to hospital care.

The course for training dental assistants, mentioned in the 1934 report, is being continued. This course offered by the New York City Board of Education is given partly at the clinic and partly at the Central School of Business and Arts. Two classes are enrolled annually, each course being concluded in one semester.

*Director.

Report of Murry and Leonie Guggenheim Dental Clinic
Jan. 1 — Dec. 31, 1935

Census

Total patients registered in clinic to Dec. 31, 1935		20,265
New patients, 1935		3,308
Age 1 to 5	743	
Age 6 to 12	2,437	
Over 12	128	
Total patients, new and old, 1935		11,240
Total visits to clinic		56,810
Total visits to all departments		70,249
Total cases completed		2,943
New patients	1,125	
Recalled patients	1,818	
Discharged (over age limit or moved from district)		2,891
Readmitted		383

Caries in Preschool Patients by Ages

Age	Per Cent with Cavities	Per Cent with Seven or More Cavities
2	50	18
3	80	42
4	92	53
5	96	61

Oral Diagnosis Department

Total visits		17,860
Total x-ray examinations		20,815
New patients, as above		3,308
Free from caries		40
Percentage of patients with caries		98.8
No operative work needed		19
Total caries		35,762
Caries per patient		10.8
Marked gingivitis		227
Referred to rhinologist		395
Recalled patients		4,114
Free from caries		19
Percentage of patients with caries		99.5
No operative work needed		448
Percentage of patients free from caries or needing no operative work		11
New caries		13,683
New caries per patient		3.3
Recurrent caries		76
Percentage of recurrent caries (1935) to permanent fillings (1934)		0.1

Operative Department

Total visits		42,067
Prophylactic treatments		7,663
by dentists	296	
by hygienists	7,367	
(by hygienists in hospital—not included in clinic total)	2,470	
Fillings		53,799
Temporary, zinc oxyphosphate	937	
zinc oxide eugenol, carious exposure	1,844	
*Permanent		51,018

*Each surface of a tooth involved counts as one filling.

Fillings polished (not surfaces)			12,311
Cavity preparation			2,322
Silver nitrate treatment			2,349
Root canal therapy			862
Treatment	534		
Filling	125		
Pulpotomy	203		
Gingivitis treatment			381
Occlusal adjustment			1,356
Total operations			81,043
Oral Surgery Department			
Total visits			10,322
Extractions			11,745
Deciduous	10,150		
Permanent	1,595		
Anesthetics			6,948
Local		4,829	
Procaine	4,287		
Ethyl chloride	542		
General		2,119	
Nitrous oxide-oxygen	2,061		
Ethyl chloride	58		
Postoperative treatment			2,336
Special operations			174
Apicoectomy		20	
Drainage of subperiosteal abscess		41	
Surgical removal of cyst		3	
Gum flap		72	
Labial frenum		7	
Malposed tooth		8	
Retained root		8	
Supernumerary tooth		15	

1935 REPORT OF THE ROCHESTER DENTAL DISPENSARY*

In the founding of the Rochester Dental Dispensary, Mr. Eastman recognized that the prevention of disease is of more importance than its treatment. While relief and reparative work is necessary, the ultimate object sought is the development of methods and practices to prove the value of preventive dentistry. The education of the parents and children is regarded as an important development in accomplishing this object.

One of the provisions of Mr. Eastman's gifts of $2,800,000 to endow this dispensary was that the City of Rochester should contribute not less than $12,000 a year for five years, to carry on the prophylactic work in the public schools. In 1916, a contract was made with the City of Rochester to this effect. The contract was renewed in 1921 for a period of five years, at $25,000 per year; again in 1926, and, in 1931, for another period of five years at $30,000 a year. It is understood, in making this contract, that the city has no control of the work of the dispensary, and no part of the contribution is used to defray any of the expenses of the work.

Other cities could be interested in doing

*Harvey J. Burkhart, D.D.S., Director.

similar work for the same reasons. Local dental organizations, or even individual members, can do much toward establishing dental aid in their communities. It is not difficult to interest people in health care that will prevent disease, if it is for children. There is a magic appeal in the thought that the plan is to aid children by giving them a better chance to become healthful and helpful citizens.

CALIFORNIA HEALTH INSTITUTE

The exhibit here illustrated is the dental section of a traveling health institute developed jointly by the California State Medical Society and the California State Dental Association. Frederick C. Warnshuis, secretary of the California State Medical Society, is actively in charge.

Dental health section of traveling health institute developed jointly by California State Medical Society and California State Dental Association.

Under this plan, the state societies encourage the county medical and dental societies and their woman's auxiliaries to promote health educational institutes in their own communities. The state societies furnish the main exhibits, while the local health agencies furnish additional material. The first institute, held in Oakland, Alameda County, proved highly successful. From there, the larger exhibits were shipped to San Diego, where they are to be on display until the end of the fair in September. Next fall, they will be returned to circulation for county health institute purposes.

DENTAL ECONOMICS

THE SOCIAL SECURITY ACT

By E. E. VOYLES, D.D.S., Indianapolis, Ind.

THE Economic or Social Security Act has become an outstanding topic of discussion throughout the land. It is regarded as the most far-reaching legislation ever passed by the Congress. It contains revolutionary provisions involving the intimate life and well-being of every citizen and reversing the age-old philosophy of personal responsibility, thrift, frugality and self-reliance.

The act substitutes long-distance central control for local determination of many welfare problems. Under this act, it becomes necessary for all states to set up laws, make plans and provide state funds in order to share in the distribution of federal subsidies. This is accomplished by means of federal taxation. In the case of unemployment compensations, these taxes would penalize any state that fails to adopt employment insurance. All these state laws must be acceptable at Washington. With minor exception, this act offers no federal gifts, but all titles under the act are based on dollar matching, with the government dictating the terms.

CENTRAL ADMINISTRATION

The major provisions of the act are under the control of the Department of Labor and are administered through the Social Security Board and the Children's Bureau.

The board consists of three members appointed by the President. Each receives a salary of $10,000 a year and must not engage in any other occupation. The present members are: John G. Winant, chairman, Arthur J. Altmeyer and Vincent M. Miles. Frank Bane is executive director, and the present staff consists of about 100 persons. The board is given rather broad powers for making interpretations and establishing rules and regulations to carry out the purposes of the act.

In addition to administration, the board is delegated the duties of "studying and making recommendations as to the most effective methods of providing economic security through social insurance and as to legislation and matters of administrative policy concerning old age pensions, unemployment compensations, accident compensations and related subjects." This quotation is the most significant phrase in the entire law and may mean much to both the medical and the dental profession. It is clearly evident that the law was promoted by a socialistically inclined group who are strong advocates of insurance.

STATE CONFORMITY

The law is so hazy as to defy efforts toward a clear understanding of its many provisions. States attempting to revise their laws in conformity to the federal act must rely on the Social Security Board for its meaning. Politicians and social workers are quick to find in these acts the basis for a huge bureaucracy of

public welfare workers. Unsupported claims are therefore being made by this group as to the qualification requirements of the administrative personnel of the states and counties.

Contradictory to the selfish aims at promoting the socially trained groups, significant interpretations were given verbally by Mr. Frank Bane, executive director, of the Social Security Board, in response to inquiries by interested citizens dispatched to Washington to ascertain the facts. They are as follows:

In order to meet the requirements of the Social Security Board, it is not necessary (1) that the state board approve of the county board members and employes; (2) that the board members of the county have definite qualifications fixed by the state boards; (3) that the state board have power of removal of county board members or its employes, nor (4) that the county board members or employes have completed a definite course of instruction in social welfare.

There is nothing in the Social Security Act which prescribes any specific method of administration in political subdivisions of the state.

The state is required to provide a plan which shall be mandatory upon all political subdivisions of the state if administered by them and a plan which shall provide for efficient operation in the political subdivisions of the state. The matters relating to selection, tenure of office and compensation of personnel are reserved to the state.

There is nothing in the act having to do with the administration of hospitals for the insane, penal institutions, reformatories or county infirmaries.

SPOILS SYSTEM OR MERIT SYSTEM

The Social Security Act has no provision whereby civil service rules shall govern appointments for positions under the act. This opens up another large field where the "ins" and the "outs" may battle for the plunder of the public payroll. The states may establish laws that will load the payrolls with political workers or they may provide a merit system, which will bring into the welfare department persons of special attainments and experience. The importance of this choice cannot be overestimated. The choice will affect the state boards and the various county boards and hundreds of employes whose duty it will be to investigate applications for aid, keep in touch with those to whom aid is granted, see that funds are collected and paid out, and investigate questions of fraud, racketeering and political favoritism.

Shall the appointees who are to administer this huge undertaking be chosen because they are "right" politically and have some skill in connecting aid with votes, or will they be selected on a competitive basis as to ability and hold their positions as long as they do their work right and abstain from partisan political activity? "Political clearance," or a certificate of party regularity, may unfortunately play a part in the administration of aid to the unfortunate. Responsibility in this matter rests heavily on the legislatures of the various states. Some legislatures have had the forethought to provide in their laws that the state and county administrative boards shall be composed of representative citizens, who shall receive their appointment through court judgeships and who serve without pay. This is intended to afford some measures of protection against political pillage.

SUPPLANTING LOCAL CONTROL

This far-flung program of social security will inevitably supplant community efforts and sound the death knell of local autonomy. Many communities have long-established welfare agencies that are administered locally and in a large measure gratuitously by public-spirited citizens

whose names read like a page from "Who's Who." Such persons contend that "blue-print patterns" are not tailored to local needs, that voluminous instructions, intricate record systems and meaningless red tape hinder rather than help. Undoubtedly, such interference by paid social agents will drive out gratuitous efforts. Time alone will reveal whether economic security centralized in Washington will promote human welfare and happiness commensurate with the burdens it entails and the expectations this act has aroused. The measure of security in certain provisions of the act may be disappointing to those who have been taught to lean heavily on the arm of paternalism.

Long-distance planners often reveal a woful lack of information regarding the needs of backward communities.

For example, Brown County, Indiana, is known nationally as the most backward county in the state. It is there that the government has concentrated its uplifting activities. And this county has only about 8 per cent on relief, while Marion County, including Indianapolis, has 18 per cent, and Monroe County, seat of Indiana University, has about 33⅓ per cent on relief. Crime is practically unknown in Brown County. Contentment, happiness and independence often lurk in places accessible only with a "horse and buggy," which is perhaps unbelievable to the metropolitan mind. The land of these natives may be "submarginal," but not their management.

The entire act is compulsory in character and the tendency is to make large groups of citizens creatures of the state. Especially under the titles relating to dependent children and child welfare, the gate is thrown open wide for the propagation of any "ism" which may be the whim of the moment or which may fit any expediency.

SECURITY AND CHARACTER

Man's insecurity has ever been the motivating influence back of the development of such sterling qualities of character as thrift, industry and frugality. The fear of dependency in old age has always driven men to give of their best. Will the standing assurance of economic security affect adversely national thrift *en masse*? This question intrudes itself into any analysis of the security act. Will a measure of security in everything essential from birth to death encourage parasitism? Will our national citizenship as a whole lose some of the qualities that have made us a great nation? "Why work when the government will supply all our essential needs?" says a rapidly increasing group. "Why work, when 35 per cent of our earnings are required to pay the cost of government?" says another group. Beaumer states that it took thirty years under the German system of social insurance to undermine the honesty of the rank and file of the people. Will America, steeped in a system of political chicanery, make more rapid progress in insurance evasion, chiseling, graft and racketeering? A virgin field for many forms of trickery is opened under this act. Some years may be required to supply the answer to these questions.

CONSTITUTIONALITY

The constitutionality of this act has been seriously questioned. In fact, the unemployment compensation feature of the act was recently tested in the New York Supreme Court and an adverse decision was rendered. In another court in the same state, a favorable decision was given.

Several states have passed laws conforming, at least in part, to the federal act and others have the matter under consideration. The question arises as to where these states will stand if the law

in whole or in part is declared unconstitutional. It is estimated that Indiana will pay into the government $40,000,000 a year in new payroll taxes and the sum for New York is estimated at $90,000,000 for 1938. What will be the situation in the states if the federal law does not stand the test of the courts? Will a similar confusion result as in the case of the AAA decision? The law will probably come up for amendment many times during the coming years.

THE COST

There is no predicting what the total tax cost of this program will amount to in the whole country. It will be huge to begin with and, if it follows precedent, it will rapidly grow larger. In Germany, unemployment insurance went into effect in 1927, with 3 per cent levied on payrolls. By January, 1930, it was raised to 3½ per cent. In July, it was raised to 4½ per cent, when it became necessary for the government to subsidize it to the extent of $173,600,000 in that year. In Ohio, a workmen's compensation law was enacted in 1912. During the first three years, the average cost of operation was $1,185,814. Since that time, there has been an increase of 1,220 per cent. The last three years, the cost averaged $15,472,079. There has been an increase of about 400 per cent in taxes in this country during the last twenty years, which undoubtedly will receive a tremendous increase as a result of social insurance. On the basis of "pay as you go," the entire governmental tax bill in this country today would amount to about 25 per cent of the entire national income.

The financial plight of the principal central governments of Europe has been ascribed, in large measure, to the drain of social insurance. In America, the governmental waste that is common in most federal, state, country and city units hardly lends encouragement to the hope that this act will be administered economically. Under the act, a new layer of government is set up in each state, requiring hundreds of new state office holders and employes. A recent survey in Indianapolis showed that U. S. Agencies occupy 10,430 more square feet of floor space than the entire state capitol, including the attic. Social Insurance is so complicated as to require an elaborate system of expensive accounting, checking and actuarial computation, besides elaborate machinery for controlling the costs and the prevention of fraud. The outlay for social insurance will inevitably become a major item in all state and federal budgets.

DIVISIONS OF THE ACT

The federal act is divided into eleven titles or separate laws.

Title 1: Old Age Assistance.—This means money payments to needy old persons and carries an appropriation of $49,750,000 for the current fiscal year and a sum sufficient annually thereafter; also, an appropriation of $250,000 for administrative expenses of the Social Security Board under this title.

Payment to states: 1. All states must have plan approved by the Social Security Board. If requirements are not carried out by the state, federal payments will stop. 2. State contributions up to but not exceeding $15 per month are matched. 3. The state plan is mandatory in all counties.

Qualifications to receive assistance: 1. The age must not be over 65 years after 1940. Age 70 may be required previous to that date. 2. The recipient must not be an inmate of a public institution.

Title 2: Federal Old Age Benefits.—In addition to old age assistance, the act provides for old age annuities to be paid from the "Federal Old Age Account"

created in the U. S. Treasury and based on the principle of actuarial computation. These payments do not begin until Jan. 1, 1942, and the beneficiary must have attained the age of 65 and not be employed by another person in a gainful occupation. The amount of the annuity depends on the duration of the period over which an individual has paid payroll income taxes and his average monthly wages after Dec. 31, 1936. Funds to support this account are presumably taken from payroll taxes and appropriated on recommendation of the Secretary of the Treasury to the Bureau of the Budget.

Other persons not subject to state taxes and not otherwise coming under the provisions for old age benefits may voluntarily purchase annuities in limited amounts and under specified conditions.

Title 3: Unemployment Compensation.—Compensations under this title cover persons only who have been employed and have lost their positions temporarily. Persons permanently unemployed are not covered. This is a distinctly labor section and contains reservations protecting some of the principles advocated by union labor. The plan is to impose a federal tax on all employers of eight or more as a means of forcing states to adopt compensation laws, the adoption of which will exempt the employers in the state from payment of 90 per cent of the federal tax, thus keeping the money paid by employers in the state to be used for the benefit of local workmen.

The excise tax on payrolls became effective Jan. 1, 1936, and is increased from 1 to 3 per cent over the period up to 1938. An income tax identical with the employer's excise tax is levied on the income of the employes, and must be collected by the employer under penalty. An employer is defined as one who on each of twenty days in different weeks of the taxable year employs eight or more persons. Employment exceptions are: farm labor, domestic service, crew of vessels, relatives, government employes and employes of nonprofit institutions. It is administered under the Social Security Board. An appropriation of not to exceed $4,000,000 is provided for the fiscal year and an appropriation of $49,000,000 annually thereafter.

Title 4: Aid to Dependent Children.—This title means money payments to dependent children, who are defined as under 16 years of age and deprived of parental support or care, and who are living with relatives in residence maintained by them as his or their own home. Payments are limited to $18 a month for one child, with $12 for each additional child. This subsidy also is conditioned on acceptable state plans and is under control of the Social Security Board. The government provides one third of the total sum expended in carrying out the state plan. This calls for an appropriation of $24,750,000 for the fiscal year and a sufficient sum thereafter. It also appropriates $250,000 for the fiscal year for administration.

Title 5: Maternal and Child Welfare.—This title covers maternal and child health service, services for crippled children, child welfare services and vocational rehabilitation. The first three are administered by the Children's Bureau in the Department of Labor and the last through the U. S. Department of Education.

Maternal and child health service has for its object promoting the health of mothers and children. It carries an allotment of $20,000 to each state and a part of $1,800,000 based on the number of live births in a state during the last calendar year. This also is conditioned on a state plan and financial participation acceptable to the Social Security Board.

Service for crippled children calls for an appropriation of $2,850,000 annually. An allotment of $20,000 is made to each state, with additional sums according to need. It is conditioned on state plans and financial participation. Federal funds are to be withdrawn if the state fails to carry out the requirements. Plans must be approved by the Chief of the Children's Bureau.

Child welfare service calls for an appropriation of $1,500,000 for the fiscal year, with an allocation of $10,000 to each state offering approved plans. This service is aimed at strengthening public welfare services, especially in rural areas, and the protection and care of homeless, dependent and neglected children.

Vocational rehabilitation calls for an appropriation of $841,000 for each of the fiscal years 1936 and 1937 and $1,938,000 for each year thereafter. A further authorization of $425,000 is made for the fiscal year to the Children's Bureau for expenses. All these important welfare activities are centered in the Department of Labor.

Title 6: Public Health Work.—Under this title, provisions are made to assist states and other political divisions in establishing and maintaining adequate public health service, including the training of personnel. This calls for an annual appropriation of $8,000,000. A further appropriation of $2,000,000 annually is authorized for the expenditure of the Public Health Service for investigation of disease, sanitation, etc. It covers pay allowance and traveling expenses of the Public Health Service in the additional duties imposed by this title. This operates under the Surgeon General, with the approval of the Secretary of the Treasury.

This also is contingent on the states' setting up programs acceptable to the Department of Public Health and providing state funds to be augmented by federal dollars. All plans must be presented by the health department of each state and approved by the Surgeon General of the Public Health Service. It is specified that allotments to the states from this appropriation shall be determined on the basis of population, special health problems and the financial needs of the several states.

In addition to strengthening the service divisions of the state health departments and their political subdivision, provision is made for the training of health personnel. Several medical centers throughout the country have adequate facilities for training medical personnel for public health work. As soon as facilities are available, it is understood that the government will finance the training of a selected group of dentists for public health work. They will receive some pay during the period of training.

At a meeting of the American Public Health Association last May, recommendations were made as to qualifications for health officers and health personnel. The qualifications recommended included a degree of doctor of medicine, at least one year's hospital experience, with special experience in pediatrics and infectious diseases, and some experience in general practice; the candidate to be not more than 35 years old when first specializing in public health work, with not less than three months of special training in public health and in addition some field experience. Higher qualifications for staff positions included training in biostatistics, bacteriology, immunology, water purification, sewage disposal, food purity and principles of nutrition, venereal diseases, tuberculosis and other communicable diseases, and familiarity with epidemics.

The foregoing gives an idea of the scope of training that, with some modifications, may be required of those den-

tists who hope to enter the field of public health service.

A few states now have full-time dental representation in the departments of health. The opportunity is presented under this act for organized dentistry to assume leadership in securing dental representation on all state boards of health and the establishment of dentistry in the broader field of general public health.

In order that dentistry may participate in the activities under this title, it is necessary that a program be formulated and endorsed by the State Health Department and be accepted by the Surgeon General of the U. S. Public Health Service.

This is a challenge to the leadership of organized dentistry in every state.

808 Odd Fellow Building.

CURRENT LITERATURE

Treatment of Melanoma: Report of Four Hundred Cases (Frank E. Adair, Surg. Gynec. & Obst., 62:406 [Feb. 15] 1936): The nomenclature of the malignant pigmented tumors has always been confusing. A genetic term for the entire group is melanoblastoma, which is subdivided into two classes: (1) melanosarcoma and (2) melanocarcinoma, the appellation depending on the preponderance of epithelioid or spindle cells in the tumor. Melanoma is one of the most malignant of all tumors. A fair proportion of five-year cures can be obtained. The five-year results in operable cases are 33 per cent for the primary and 27 per cent for the recurring lesion. The great majority are advanced and no therapy will produce a cure. Thirty-eight cases of five-year survivals of melanoma are reported. The best results in treatment are seen when the melanoma is situated in the eye or beneath toe nails. The worst results are associated with disease in the vulva or the rectum or within the mouth.

J. Frank Hall.

Fractures of Jaw and Allied Traumatic Lesions of Facial Structures (H. H. Weisengreen and W. N. Levin, Ann. Surg., 103:428 [March] 1936): Several tables are presented which show that the largest number of fractures occur in the mandible. Of sixty cases, fifteen were in the region of the angle and twenty in the mandibular molar region, particularly the third molar. The second table points out the fact that the highest percentage occur in the earlier years, 90 per cent being before 49 years of age and the highest percentage group being 36.7, from 20 to 29 years. The cause in most of these cases was automobile accidents and fights. Some of the points stressed in the management of fractures were early reduction, prevention of infection, adequate dietary measures and a postoperative examination and check-up. The authors found local anesthesia to be very satisfactory. Physiotherapy was found to be valuable in several cases.

M. W. McCrea.

Trigeminal Neuralgia in Multiple Sclerosis (M. M. Meredith and G. Horrax, J. Nerv. & Ment. Dis., 82:497 [Nov.] 1935): The authors report two cases: 1. A case of bilateral trigeminal neuralgia, complicated by multiple sclerosis. The two sides were treated separately. At the first operation, the sensory root was avulsed as well as the motor root. The second operation was performed at a later date and care was manifested to preserve the motor root. The authors state that numbness and paraesthesia are common, while pain is rare in multiple sclerosis. 2. The trigeminal neuralgia in this case preceded the multiple sclerosis by

more than six years. That facial pain in multiple sclerosis is due to the presence of sclerotic plaques in the pons, medulla or descending spinal root of the trigeminal nerve is unlikely in view of the relief obtained by alcohol injection or sensory root avulsion. The authors believe that the neuralgia is more apt to be bilateral when multiple sclerosis is present.

J. FRANK HALL.

Modern Therapy of Tumors of Head and Neck (A. F. Holding, Am. J. Surg., 31:454 [March] 1936): Preliminary steps in tumor treatment should include serologic tests to exclude syphilis; cleanliness and oral hygiene, and biopsy, with immediate microscopic examination. In treatment of neoplasms, the author emphasizes electrocoagulation as an efficient and economical procedure. Nine cases are reported, including fibroma, epulis, adamantinoma, aberrant parotid tumor, squamous-cell carcinoma, extensive Vincent's infection, basal-cell carcinoma, keloid and cavernous angioma. The value of group work in the modern treatment of tumors is accentuated and nine rules are given: (1) have a Wassermann test made; (2) have a biopsy; (3) do not procrastinate; (4) do not irritate mouth tumors; (5) know the clinical history of the tumor; (6) know whether it is radiosensitive or radioresistant; (7) in benign tumors, remove the cause; (8) in malignant tumors, use all methods indicated, and (9) do all operative work before irradiation.

HAMILTON ROBINSON.

Oxidation-Reduction Potentials of Certain Anaerobic and Facultative Anaerobic Bacteria: I. Eh:p_H Relationship and Possible Explanation for Phenomenon of Double Reversion of Potential During Apparent Logarithmic Phase. II. Preliminary Observations on Differentiation of Lactobacilli of Intestinal and Buccal Origin (R. W. H. Gillespie and L. F. Rettger, J. Bacteriol., 31:14, 1936 [Reported in abstract form]): This report deals with observations that illustrate the importance of the relationship between the hydrogen-ion concentration and oxidation-reduction potential in analytic work. *Lactobacillus acidophilus* strains were used because of their active growth and acid production. An apparently incidental finding in this work was that, under the conditions of the experiment, the mouth strain used established an appreciably lower final p_H (higher hydrogen-ion concentration) than did the two intestinal strains of *L. acidophilus*. The authors state that because the margin of final reduction intensity between the oral and intestinal strains was rather wide, their differentiation by means of dye indicators should be practical.

M. K. HINE.

Adenoma of Parotid Salivary Gland: Onkocyte Tumor (G. E. Gruenfeld and L. H. Jorstad, Am. J. Cancer, 26:571 [March] 1936): A case of an adenomatous tumor of the parotid, apparently a rare type, is reported. The neoplasm was in the right parotid gland of a 68-year-old white woman and had gradually increased in size over a three-year period. An encapsulated 3 by 4 cm. mass was removed and showed no evidence of recurrence in nine months. Histologically, a "benign multicentric adenomatous neoplasm, whose proliferating cell complexes originate in the duct system" is suggested. The possible onkocytic development is discussed.

HAMILTON ROBINSON.

Incidence and Significance of Presence of Borrelia Vincenti and Other Spirochaetaceae on Beverage Glasses (Don Chalmers Lyons, J. Bacteriol., 31:84, 1936 [Reported in abstract form]): This study was made of smears from rinsed glasses after their return from the customers, and from glasses placed in a rack on the bar and ready for use. Examinations revealed surprisingly high percentages of *Borrelia vincenti* and other spirochetes on beverage glasses, and suggested the necessity of better control of methods of glassware cleansing in such establishments.

M. K. HINE.

Cancer of Mouth; Care of Patient Utilizing Prolonged Anesthesia Obtained

by Alcohol Injections of Branches of Fifth Nerve (H. F. Hare, J. L. Poppen and H. B. Hoover, New England J. Med., 214: 572 [March 19] 1935): The advantages of alcohol injections in painful cancerous conditions of the oral cavity and regions supplied by the fifth nerve are given as follows: 1. The patient can carry on all daily activities without pain. 2. The loss of weight caused by failure to eat owing to the pain is negligible. 3. The oral cavity can be kept clean, and thus the chances of secondary infection are minimized. 4. The implantation of radon seeds can be done without further anesthesia. 5. The anesthesia will permit the wearing of a shield for a period after implantation, and thus the noninvolved parts will be protected.

M. W. McCrea.

Practical Evaluation of Antiseptics for Use in Oral Hygiene (M. A. Jacobson, J. Bacteriol., 31:9, 1936 [Reported in abstract form]): The author criticizes the present method of the Food and Drug Administration of the Department of Agriculture of testing antiseptics to be used in the mouth, which fails to place sufficient importance on the strength or dilution of the product and to stress the importance of the duration of application, and does not approximate the conditions attending the use of antiseptics in oral hygiene. He proposes the inclusion of "20 per cent sterile saliva" in each dilution tested, and suggests the following definition: "In oral hygiene, a product is said to possess one antiseptic unit when 4 c.c. plus 1 c.c. of sterile saliva kills 0.5 c.c. of a 24-hour broth culture of the standard Food and Drug Administration *Staphylococcus aureus* in less than one minute exposure." He believes that the antiseptic unit evaluation of antiseptics has many advantages over the present Food and Drug Administration method.

M. K. Hine.

Leukoplakia of Unusual Origin (S. S. Greenbaum, Arch. Derm. & Syph., 33:538 [March] 1936): A 19-year-old girl had a leukoplakia lesion on the under surface of the tongue. The usual etiologic factors not being present, and as the patient had the nervous habit of scraping the polish from her nails with her teeth, it was suggested that the lesion might come from the nail varnish. Extreme efforts to control the habit for two weeks resulted in a 50 per cent reduction in the lesion, but as no discomfort resulted from the patch, the patient made no further effort to control the habit and the leukoplakia recurred slightly.

Hamilton Robinson.

Aberrant Lingual Thyroid (H. Rubin, Am. J. Surg., 32:151 [April] 1936): A man, aged 30, had a history of a gradually increasing lump of five years' duration on the back of the tongue and interfering with deglutition. The general appearance of the patient suggested myxedema. A roentgenogram revealed a lingual and sublingual thyroid tumor and the basal metabolic rate was minus 26. The metabolism became normal under thyroid therapy, and surgical intervention was not attempted because of severe hemorrhage at biopsy and, in addition, because no thyroid tissue was demonstrable in the neck.

Hamilton Robinson.

Foreign Literature

Case of Agranulocytosis (H. A. Johnson, Brit. M. J., 1:415 [Feb. 29] 1936): A man, aged 52, who had poor health for ten years, lacked vitality and was easily fatigued, complained of increasing lassitude and malaise and was finally confined to his bed. A temperature of 102 F. persisted for two weeks. The patient complained of his throat, and examination revealed a bilateral enlargement of the tonsils, which were purple. On examination in the hospital, the blood picture revealed a typical agranulocytosis, with red cells, 5,280,000; white cells, 800; polymorphonuclears, 5 per cent; lymphocytes, 95 per cent, and no monocytes, eosinophils or basophils. After the first injection of pentnucleotide, the fever subsided. Roentgen-ray therapy was also given. Reappearance of the leukocytes took place six weeks after the completion of the pentnucleotide and roentgen-ray treatment. It is believed that they were not responsible

for the cure and that recovery occurred spontaneously. There is no evidence that amidopyrine in any form had ever been taken by the patient.

J. Frank Hall.

Ciliary (Migrainous) Neuralgia and Treatment (Wilfred Harris, Brit. M. J., 1:457 [March 7] 1936): Many cases of migrainous neuralgia have been mistaken for trigeminal tic. Alcohol injection or root resection as given for trigeminal neuralgia may also be of some aid in relief of migrainous neuralgia. Care should be exercised in differential diagnosis. In trigeminal neuralgia, the attacks are short and flashing, lasting from only a few seconds to two minutes. They are provoked by eating or by touching the face and exciting the trigger zone. In migrainous neuralgia, there are no such hypersensitive spots. Another type of neuralgia to be considered in the differential diagnosis is the chronic neuralgia of the jaws or the so-called atypical neuralgia, which is for most part seen in women. The author gives an extensive description of migrainous neuralgia as to occurrence, symptoms, duration and treatment. He discusses four cases.

J. Frank Hall.

Uber Doppelbrechung und Feinbau des Menschlichen Zahnbeins (A. Keil, Zietschr. f. Zellfschg., 21:635, 1934): In using polarized light in sagittal sections, the course of the collagen fibers may be seen running more or less at right angles to the dentinal tubules. In cross-section, the collagen fibers present a criss-cross appearance and the dentinal tubules each show a surrounding negative cross. The narrow layer of peripheral dentin is optically positive in relation to the dentinal tubules; an effect attributed to the fibers of von Korff, which are known to run radially, i. e., parallel to the dentinal tubules. In sections leached of organic matter, the spheres of globular dentin give negative crosses; which indicates that the crystals of mineral matter are laid down spherically. In the half-moon fields, a difference of double refraction is found before and after leaching, and consequently these areas must be real. The arrangement of the mineral matter in the half-moon fields also seems to be spherical, leading the author to suspect an embryologic connection with the globular dentin. Sometimes, areas of matrix without tubules are found. These give a negative cross. Such areas are associated with the occurrence of giant tubules.

H. C. Hodge.

Uber die Kristallorientierung im Zahnschmelz (W. F. Bale and H. C. Hodge, Naturwissenshaften, 24:141, 1936): Moller and Tromel have stated, on the basis of roentgen-ray diffraction evidence, that enamel contains a different crystal form from that found in dentin and bone. The authors, from the same kind of evidence, find that an orientation of the crystals in enamel is assumed, and the enamel diffraction pattern arises from the same crystal form as is found in dentin and bone.

H. C. Hodge.

Avertin Anesthesia for Dental Operations on Children (G. Bremer, Nord. med. Tidsskr., Dec. 21, 1935, p. 2092; abstr. Brit. M. J., 1:41 [Jan.] 1936): The author discusses forty cases, most of which were in children under school age. Avertin anesthesia eliminates the possibility of complications such as bronchial infections and others frequently manifested when other types of general anesthesia are used. The author is able to employ root-canal therapy and perform various other painful operations that would be very difficult without general anesthesia. Avertin anesthesia is very useful in young adults who are hypersensitive, neurotic or of unstable mentality.

J. Frank Hall.

Cardiac Failure During Anesthesia (K. Bremer, So. Afr. M. J., Nov. 9, 1935, p. 755): The author believes that strong rhythmic pressure on the ventricles is necessary in treating total cardiac failure during anesthesia. An incision is made in the abdomen in the region between the liver and the diaphragm. Two fingers are passed through the incision and to the heart, forc-

ing it against the thoracic wall. The heart should begin to beat in one or two minutes, but not regularly. The rhythmic pressure and release, accompanied by artificial respiration and oxygen therapy, should be continued until the breathing and heart beat are regular. Bremer states that the procedure is comparatively simple and probably safer than intracardiac injection.

J. FRANK HALL.

MISCELLANY

BOOK REVIEWS

Dental Formulary. A Practical Guide for the Preparation of Chemical and Technical Compounds and Accessories as Used in the Office and Laboratory by the Dental Practitioner. With an Index to Oral Diseases and Their Treatment. By Hermann Prinz, A.M., D.D.S., M.D., Sc.D., Dr. med. dent., professor of materia medica and therapeutics, The Thomas W. Evans Museum and Dental Institute, School of Dentistry, University of Pennsylvania, Philadelphia. Fifth edition, thoroughly revised; 1936. 12mo, 366 pages. Limp binding, $3.50, net. Published by Lea & Febiger, Philadelphia.

The fact that a book of this type has gone to the fifth edition is pretty conclusive evidence that it has merit of a high order. Dr. Prinz has brought to the preparation of this volume almost a lifetime of effort, and his ripe experience has brought forth fruit in the form of well-digested and authentic information on the topic. The subjects are so numerous that it would be difficult to mention any drug or combination of drugs that had not been considered by the author. Not only that, but investments and molding materials also are considered, as well as filling materials and other products that are used by dental practitioners. In fact, the present volume is filled with practical information of value to every dentist and it is commended most highly.

Roentgenographic Technique. A Manual for Physicians, Students and Technicians. By Darmon Artelle Rhinehart, A.M., M.D., F.A.C.R., professor of roentgenology and applied anatomy, School of Medicine, University of Arkansas; roentgenologist to St. Vincent's Infirmary, Baptist State Hospital, Missouri Pacific Hospital and the Arkansas Children's Hospital, Little Rock, Ark. Second edition, thoroughly revised; 1936. Octavo, 431 pages, illustrated with 183 engravings. Cloth, $5.50, net. Published by Lea & Febiger, Philadelphia.

This is one of the most complete and satisfactory treatises on the subject that has come to hand. Every conceivable structure requiring roentgen-ray investigation and interpretation is not only outlined in the text but is also amply illustrated. The chapter on the teeth consists of approximately twenty pages with about the same number of illustrations. The selections are good and well timed, but unfortunately the dental nomenclature is not in accord with the latest established procedure, nor does it conform to the ideas of the Committee on Nomenclature of the American Dental Association. To displace "cuspid" with "canine" and "bicuspid" with "premolar" is hardly in keeping with the latest findings on this important subject, but, in extenuation, it should be said that the book is written from the point of view of the medical man rather than of the dentist, and it is only fair to assume that when teeth are being discussed, the dentist may naturally be expected to deal more in the niceties of dental literature than does the medical man. The book as a whole is to be highly commended.

CORRESPONDENCE

LEGISLATION

To the Editor:

The editorial under the caption "Legislative History of the Dental Corps of the

Navy," appearing on pages 483 and 484 of the March, 1936, issue of THE JOURNAL was quite interesting and illuminating, but unfortunately no reference was made to the Act of July 1, 1918, which granted the dental officers equal status with the medical officers of the Navy. This is generally recognized as being the most important Navy Dental Corps legislation ever enacted. It may be briefly outlined as follows:

The Act of July 1, 1918, authorized the President to appoint and commission dental officers in the Navy at the rate of one for each thousand of the total authorized number of officers and enlisted men of the Navy and Marine Corps in the grades of assistant dental surgeon, passed assistant dental surgeon and dental surgeon.

The act provided original appointments to the Dental Corps to be made in the grade of assistant dental surgeon, with the rank of lieutenant (junior grade) and that all dental officers appointed under the acts of August 22, 1912, and August 29, 1916, or who might be appointed should take rank and precedence with Naval medical officers of the same rank according to the dates of commission or original appointment, and that dental officers should be eligible for advancement under the same conditions as medical officers with or next after whom they took precedence and should receive the pay and allowances of medical officers of corresponding rank and service up to and including the rank of lieutenant commander.

This legislation further provided that dental surgeons were eligible for advancement in pay and allowances, but not in rank to and including the pay and allowances of commander and captain and removed the heretofore required time of two years' probationary service by providing for immediate permanent appointments. It also transferred the Dental Reserve Corps into the Naval Reserve Force, which harmonized with all the other Reserve Officers of the Navy.

Anyone interested in reading the full details of this legislation, will find it on pages 877 and 878 of the August, 1918, issue of THE JOURNAL. Also, an appropriate editorial will be found on pages 868 and 869 of the same issue.

HOMER C. BROWN,
609 Hartman Bldg.,
Columbus, Ohio.

CLASSIFICATION OF MEMBERS OF BRITISH SOCIETIES

To the Editor:

May I call attention to the classification of members of the three British Dental Societies, made in the annual address of the President of the A.D.A. and published in the December, 1935, issue of THE JOURNAL, page 2029.

I am advised by Mr. S. Donald Cox, general secretary of the Public Dental Service Association of Great Britain, Limited, that this association is comprised of members who have had organized institutional dental training as well as those who have not had such training. Dentists who have had organized institutional dental training are designated as qualified and those who have not had this training are generally designated as unqualified.

I am further informed that the three dental organizations are cooperating in an effort to secure more favorable provisions in the National Health Insurance Act. I regret that an error occurred in this classification.

FRANK M. CASTO,
1338 Keith Bldg.,
Cleveland, Ohio.

NEWS

DEATHS

Barnett, James Joseph, Joplin, Mo.; University of Louisville, School of Dentistry, 1907; died recently; aged 55.

Bonnell, A. E., Muskogee, Okla.; Western Dental College, 1893; died March 30.

Dillon, G. B., Sterling, Ill.; Ohio College of Dental Surgery, University of Cincinnati, 1884; died February 29; aged 79.

Dunbracco, William Winfield, Baltimore, Md.; Baltimore College of Dental Surgery, 1888; died January 12; aged 75.

Englander, Isadore, Cleveland, Ohio; School of Dentistry, Western Reserve University, 1898; died February 28; aged 71.

Essig, Frank H., Dowagiac, Mich.; University of Michigan, College of Dental Surgery, 1888; died January 20; aged 70.

Lehman, Emanuel, Brooklyn, N. Y.; University of Maryland, Dental Department, 1899; died February 22.

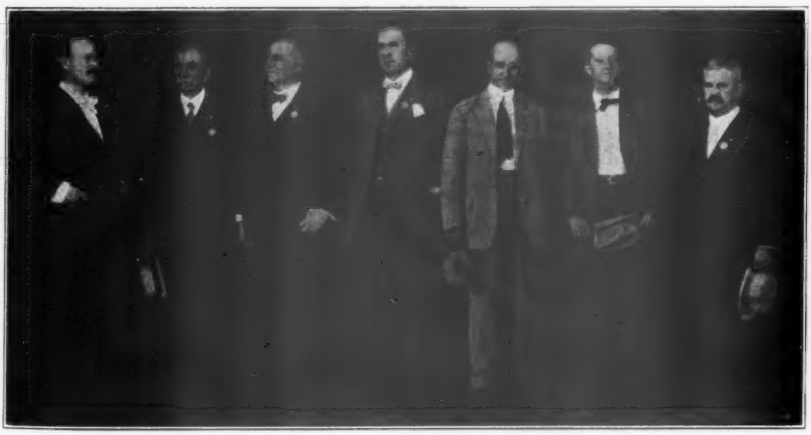
Lovett, Guy Dudley, Cleveland, Ohio; Chicago College of Dental Surgery, 1908; died March 4; aged 62.

Roberts, Jewell Clarence, Los Angeles, Calif.; Tulane University School of Dentistry, 1919; died March 31, after a brief illness; aged 44. At the time of his death, Dr. Roberts was president elect of the Southern California State Dental Association. He was active in organizational work and an orthodontist of note. The widow and two daughters survive.

Sharp, Peter J., Tillamook, Ore.; North Pacific College of Oregon, 1902; died February 27; aged 66.

Towne, Roy Salem, Bismarck, N. D.; State University of Iowa College of Dentistry, 1907; died February 24, as the result of injuries received when he was struck by a milk truck while walking on the station platform at Jamestown. Dr. Towne was 50 years of age. He was very active in the profession. The widow, a son and a daughter survive.

Vaughan, Frank, Astoria, Ore.; College of Dentistry, University of California, 1900; died January 23.



Officers of the National Dental Association elected in Denver at the 1910 meeting. Left to right: Charles W. Rodgers, Dorchester, Mass., Corresponding Secretary; Edward S. Gaylord, New Haven, Conn., President; Charles S. Butler, Buffalo, N. Y., Vice President (East); Homer C. Brown, Columbus, Ohio, Recording Secretary; Eugene R. Warner, Denver, Colo., Vice President (West); John W. David, Corsicana, Texas, Vice President (South); Arthur R. Melendy, Knoxville, Tenn., Treasurer.

THE SEVENTY-EIGHTH ANNUAL SESSION OF THE AMERICAN DENTAL ASSOCIATION: WHAT IT MEANS TO YOU

By GEORGE B. WINTER*

OUR annual meeting will be held in San Francisco, Calif., July 13-17. This meeting is most important, and the time and place are ideal for a vacation. An occasion will be afforded of meeting friends of other days and other places. A chance will be given to hear the ablest and most far-seeing members of our profession. There will be plenty of opportunity to see the newest appliances, to study the latest theories and to make new contacts and renew old.

One cannot stress too much the meetings of the scientific sections and the clinics. They have very great professional interest and value. There are outstanding figures on the program, and contributions will be made that will be worth a journey across a continent. If one would keep up-to-date professionally, attendance is well nigh imperative.

But apart from considerations of health and pleasure and recreation, and aside from the immense value of contacts and the freshening and revivifying and modernizing of our varied abilities and scientific knowledge, there is another phase of the meeting that is trenchant:

Change in all things is inevitable. Some changes are perceptible; some, imperceptible. Some have a passing effect; some, a profound one. The changes witnessed by our organization since the last annual meeting have been of extreme importance. These changes affect all of us, consciously or unconsciously. They are of all kinds: economic, social, legislative, bureaucratic and what not. Some of them we may like; some we may choose; some may be forced on us. But whether we like, or whether we choose; or whether we are to have certain things forced on us, it is certainly wise to be cognizant of the situation with which we are face to face. I know of no way to become better acquainted with what the future holds in store for us than to be present, if it is at all possible, at this annual meeting, where the thought of the best minds of our profession will be available to us.

A great prophet once asked, "Can the Ethiopian change his skin or the leopard his spots?" One might ask now, "How much can American dentistry change from its ideas and ideals of the past?" We shall probably be hard put to it not to give up some of what has been called our "rugged individualism."

There is little to be gained in mourning over the inevitability of change. Shall we continue to be stand-patters? Is it wiser to inaugurate some changes ourselves? These are some of the problems that will face us when we meet at the Golden Gate. May the spirit of prophecy descend on us and may dentistry give fitting answer to the queries that confront us with gathering urgency.

Be sure to enter on your calendar, "July 13 to 17, San Francisco."

*President of the American Dental Association.

San Francisco—A City to Enjoy†

After arriving in San Francisco, it won't take you long to learn why it is called "the most thrilling city in America." If this is your first visit to the metropolis beside the world-famed Golden Gate, you are likely to find yourself enthralled by the illusion of living in the midst of and witnessing some of the most stirring, most romantic events in Far Western history.

Rather instinctively, your thoughts are wafted magically afar into the past, when daring Spanish frontiersmen dominated the precarious situation, due to Indian resistance, during the revolutionary days of 1776. Or, in the Civil War era, when the late King Edward VII of the British Empire, then the Prince of Wales, went to that town for a gay round of social festivities prior to going into retreat in the great geyser country of Sonoma County, California, where he took baths in mud scooped out of a weird and mysteriously hot mud glacier, still as active as ever today.

Just because it seems safe to assume that you who attend the Seventy-Eighth Annual Session of the American Dental Association next July 13 to 17 will want to see the innumerable sights of San Francisco from A to Z, we suggest that, at the beginning, you do not miss the finny marine curiosities to be found in the Aquarium in the Golden Gate Park, and, by all means, visit the Museum of Natural History and African Hall, while there. Then, after including on your sight-seeing itinerary Chinatown, the largest Chinese settlement outside of China; Little Italy, just beyond, where you will get all the feeling of being in the old country; the Embarcadero, where merchant ships of the seven seas mingle with mighty ships of war and at the end of which is Fishermen's Wharf, lined with unique fish grottos; do not fail to go all the way to Z by visiting Fleishhacker's Zoo.

There, besides seeing one of the most interesting zoological collections in the country, you will see and may swim in the very largest outdoor swimming pool in the world. And close by is the Pacific ocean, along which, from Fleishhacker's Zoo northward for a full 2 miles, is one of the truly fine beaches of the West Coast. One of the most interesting features of this beach lies offshore from the famous Cliff House—Seal Rocks, they are called, because daily great herds of seals and sea-lions may be seen sunning themselves on them.

As you no doubt know, next to New York, San Francisco is the most cosmopolitan city in the United States. Although its Chinatown is its best known foreign quarter, also extremely interesting are the Russian, Japanese, German and Jewish colonies. Then, on Telegraph Hill will be found an entrancing Little Bohemia, where dwell noted artists, sculptors, poets and novelists of various nationalities. And, along the waterfront, one may brush shoulders with strangers from most every land on the face of the earth, and a stroll along certain sections of the Embarcadero will remind one of the Biblical Tower of Babel, because of the many and widely different languages spoken there.

Yes, it is a certainty that you will enjoy San Francisco. No one ever heard of any visitor who did not. It is a place where time is too eventful to drag for a fraction of a minute. And last, but not least, this city centers one of the world's most remarkable vacationlands. It is literally surrounded by nature's wonders, including the indescribable Redwood Empire, where the oldest and biggest trees in the world grow; the amazing geysers of Sonoma County; the petrified forest only 58 miles away; great mountain eminences such as Lassen Peak, the only recently active volcano in the United States, exclusive of Alaska and Hawaii, and many matchless inland seas, notably Lake Tahoe, noted as "the lake of the sky."

†By Sanford M. Moose, Chairman, Publicity Committee.

ANNOUNCEMENTS*

CALENDAR OF MEETINGS

American Dental Association, San Francisco, July 13-17.

American Academy of Periodontology, San Francisco, July 9-11.

American Association of Dental Editors, San Francisco, July 11.

American Academy of Restorative Dentistry, San Francisco, July 11-12.

American College of Dentists, San Francisco, July 12.

American Society for the Promotion of Dentistry for Children, San Francisco, July 13-14.

American Society of Oral Surgeons and Exodontists, San Francisco, July 10-11.

Association of American Women Dentists, San Francisco, July 13-17.

National Board of Dental Examiners, May 22-23.

American Dental Society of Europe, August, 1937.

International Association for Dental Research (San Francisco Section), San Francisco, July 13.

International Dental Congress, Vienna, August 2-8.

Central Pennsylvania Seventh District Dental Society, Johnstown, May 4-6.

Texas-Oklahoma-Dallas County, Dallas, August 31-September 4.

Texas State Dental Society and Texas Association of Oral Surgeons and Exodontists, Dallas, June 8-12.

Society for the Advancement of General Anesthesia in Dentistry, New York City, third Monday in February, April, October and December.

District of Columbia at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

British Empire Dental Meeting, London, July.

Montreal Dental Club Fall Clinic, Montreal, October 14-16.

Ontario Dental Association, Toronto, May 18-20.

American Dental Hygienists' Association, San Francisco, July 13-17.

American Dental Assistants Association, San Francisco, July 13-17.

New England Health Education Association, Cambridge, Mass., June 5-6.

STATE SOCIETIES

May

Arkansas, at Little Rock (11-13)
Georgia, at Atlanta (11-13)
Illinois, at Peoria (12-14)
Indiana, at Indianapolis (18-20)
Iowa, at Des Moines (5-7)
Maryland, at Baltimore (4-6)
Nebraska, at Lincoln (18-20)
New York, at New York City (12-15)
North Carolina, at Pinehurst (11-13)
North Dakota, at Bismarck (7-8)
Tennessee, at Memphis (4-6)
South Dakota, at Sioux Falls (4-6)
Utah, at Salt Lake City (21-23)
Vermont, at Burlington (13-15)
Virginia, at Roanoke (4-6)
West Virginia, at Fairmont (18-20)

June

Idaho, at Pocatello (1-3)
Maine, at Portland (26-27)
Missouri, at St. Louis (8-10)
New Hampshire, at Sunapee (29-30)

July

Colorado, at Denver (6-9)
Wyoming, at Sheridan (13-14)

August

Texas, at Dallas (31-September 4)

September

Southern California, at Los Angeles (21-23)

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

October
Florida, at Orlando (5-7)

November
Puerto Rico, at Mayaguez

STATE BOARDS OF DENTAL EXAMINERS

Alabama, at Birmingham, June 29. E. W. Patton, Comer Bldg., Birmingham, Secretary.

Arizona, at Flagstaff, August 3. R. A. McCall, 719 Professional Bldg., Phoenix, Secretary.

Arkansas, at Little Rock, June 15-18. Clarence W. Koch, Donaghey Bldg., Little Rock.

California, at Los Angeles, June 15, and at San Francisco, May 25. Kenneth I. Nesbitt, 450 McAllister St., San Francisco, Secretary.

Colorado, June 23-27. David J. Tepley, 807 Republic Bldg., Denver, Secretary.

Connecticut, at Hartford, June 23-27. Almond J. Cutting, Southington, Recorder.

Delaware, June 17-18. Charles R. Jefferis, Wilmington, Secretary.

Florida, at Jacksonville, June 22-26. H. B. Pattishall, 351 St. James Bldg., Jacksonville, Secretary.

Indiana, at Indianapolis, June 16-19. J. M. Hale, Mt. Vernon, Secretary.

Kentucky, June 5-8. Robert L. Sprau, 970 Baxter Ave., Louisville, Secretary.

Louisiana, at New Orleans, June 10-13. Joseph L. Webre, New Orleans, Secretary.

Maine, at Augusta, June 22-24. Alton H. Swett, 192 State St., Portland, Secretary.

Massachusetts, at Boston, June 10-13. Francis M. Cahill, 141 State House, Secretary.

Minnesota, at Minneapolis, June 19-25. Paul Hagen, Crookston, Secretary.

Mississippi, at Jackson, June 16. T. Ford Leggett, Laurel, Secretary.

Nebraska, at Lincoln and Omaha, June 15-20. Mrs. Clark Perkins, Lincoln, Director.

New Jersey, June 29-July 4. John C. Forsyth, 148 W. State St., Trenton, Secretary.

New Mexico, at Albuquerque, June 22-24. J. J. Clarke, Artesia, Secretary.

North Dakota, at Fargo, July 14-17. W. E. Cole, Bismarck, Secretary.

Ohio, at Columbus, June 22. Morton H. Jones, 1553½ North Fourth St., Columbus, Secretary.

Pennsylvania, at Philadelphia and Pittsburgh, June 16-20. W. A. McCready, Highland Bldg., Harrisburg, Secretary.

South Carolina, at Columbia, June 15-17. David Aiken, Winnsboro Bank Bldg., Winnsboro, Secretary.

South Dakota, at Sioux Falls, June 22-25. H. C. Whitney, Wessington Springs, Secretary.

Tennessee, at Memphis, June 8. B. C. Gallimore, Commercial Bank Bldg., McKenzie, Secretary.

Texas, at Houston, June 15-18. R. T. Weber, Norwood Bldg., Austin, Secretary.

Vermont, at Montpelier, June 29-July 1. H. B. Small, Burlington, Secretary.

Virginia, at Richmond, June 9. John M. Hughes, Medical Arts Bldg., Richmond, Secretary.

West Virginia, June 29-July 1. Henry C. Hill, 804 Quarrier St., Charleston, Secretary.

Wisconsin, at Milwaukee, June 22-26. S. F. Donavan, Tomah, Secretary.

COLORADO STATE DENTAL ASSOCIATION

The Colorado State Dental Association invites all members of the American Dental Association from other states, particularly the eastern states, to stop over in Denver for Colorado's Golden Jubilee Meeting, July 6-9, while en route to the San Francisco meeting of the A.D.A.

OLIVER H. DEVITT, *Secretary*,
523 Republic Bldg.,
Denver.

IDAHO STATE DENTAL ASSOCIATION

The Idaho State Dental Association will meet June 1-3 at Pocatello.

STEWART BARKDULL, *Secretary*,
Blackfoot.

TEXAS STATE DENTAL SOCIETY

The fifty-sixth annual convention of the Texas State Dental Society will be held in Dallas, August 31-September 4, in conjunction with the Texas Centennial Exposition. For additional information, address

J. G. FIFE, *Secretary,*
Medical Arts Bldg.,
Dallas.

ARIZONA STATE DENTAL BOARD

The Arizona State Dental Board will meet in Flagstaff the week beginning August 3 for the examination of applicants for license to practice dentistry in the State of Arizona. Applications must be in the hands of the secretary at least fifteen days before the meeting. For further information, address

R. A. MCCALL, *Secretary,*
719 Professional Bldg.,
Phoenix.

MASSACHUSETTS BOARD OF DENTAL EXAMINERS

The next examination to be conducted by the Massachusetts Board of Dental Examiners will be held in Boston, June 10-13. All applications must be filed at the office of the secretary at least ten days before the date set for the examination. For further information, address

FRANCIS M. CAHILL, *Secretary,*
141 State House,
Boston.

MINNESOTA STATE BOARD OF DENTAL EXAMINERS

The next examination of the Minnesota State Board of Dental Examiners will be held at the College of Dentistry, University of Minnesota, Minneapolis, June 19-25, for licenses to practice dentistry and dental hygiene in the state. There is reciprocity with North and South Dakota. All applications must be filed with the secretary at least ten days prior to the examination. Address all communications regarding particulars to

PAUL HAGEN, *Secretary,*
Crookston.

STATE OF NEBRASKA EXAMINING BOARD

The next dental examination of the State of Nebraska Bureau of Examining Boards will be given June 15-20. The practical examination will be held the first three days at the University College of Dentistry, Lincoln, and Creighton College of Dentistry, Omaha. The written examination will be held the last three days at the State House, Lincoln. All applications should be on file at least fifteen days prior to the date of the examination.

MRS. CLARK PERKINS, *Director,*
Bureau of Examining Boards,
Lincoln.

SOUTH DAKOTA STATE BOARD OF DENTAL EXAMINERS

The South Dakota State Board of Dental Examiners will conduct examinations June 22-25 at Sioux Falls. For further information, applications, etc., address

H. C. WHITNEY, *Secretary,*
Wessington Springs.

TENNESSEE BOARD OF DENTAL EXAMINERS

The Tennessee Board of Dental Examiners will hold its annual examinations of dentists and hygienists June 8, beginning at 8 a.m., at the University of Tennessee Dental College, Memphis.

B. C. GALLIMORE, *Secretary,*
Commercial Bank Bldg.,
McKenzie.

WISCONSIN STATE BOARD OF DENTAL EXAMINERS

(Correction of Dates)

The next meeting of the Wisconsin State Board of Dental Examiners will be held at the Milwaukee College of Dentistry, Milwaukee, June 22-26.

S. F. DONOVAN, *Secretary,*
Tomah.

AMERICAN ASSOCIATION OF DENTAL EDITORS

The sixth annual meeting of the American Association of Dental Editors will be held in the St. Francis Hotel, San Francisco, July 11.

O. W. BRANDHORST, *Secretary,*
4500 Olive St.,
St. Louis, Mo.

AMERICAN COLLEGE OF DENTISTS

The American College of Dentists will hold its annual convocation at the St. Francis Hotel, San Francisco, July 12.

O. W. BRANDHORST, *Secretary,*
4500 Olive St.,
St. Louis, Mo.

PAST PRESIDENTS' LUNCHEON

The Past Presidents' Club of the American Dental Association will hold its annual luncheon at 12:30, July 14, at the St. Francis Hotel. The annual address will be delivered by Thomas B. Hartzell. All Past Presidents in attendance at the San Francisco meeting are requested to be present at this luncheon.

HOMER C. BROWN, *Secretqry,*
609 Hartman Bldg.,
Columbus, Ohio.

INTERNATIONAL ASSOCIATION FOR DENTAL RESEARCH

The San Francisco Section of the International Association for Dental Research will meet for luncheon in the St. Francis Hotel, July 13, at 12 m. All members attending the Annual Session of the A.D.A. are invited.

INGO HACKH, *Secretary,*
344 Fourteenth St.,
San Francisco.

EXAMINATION FOR APPOINTMENT IN THE DENTAL CORPS OF THE NAVY

A competitive examination to select not more than twenty for appointment in the Dental Corps of the Navy, when their services are required, will be held July 20, at the Naval Dental School, Washington, D. C., Naval Training Station, Great Lakes, Ill., and Naval Training Station, San Diego, Calif. A candidate for appointment in the Dental Corps must be a citizen of the United States, and must be between 21 and 32 years of age at the time of appointment, a graduate of a standard dental college, of good moral character and of unquestionable professional repute. Credentials relative to character, citizenship, date of birth and education must be submitted and approved before an applicant can be authorized to appear for examination. A circular which contains full information relative to the Dental Corps and describes the method of making application for appointment can be obtained from the Bureau of Medicine and Surgery, Navy Department, Washington, D. C.

P. S. ROSSITER, *Surgeon General,*
U. S. Navy.

EXAMINATION FOR APPOINTMENT IN THE DENTAL CORPS, U. S. ARMY

There will be an examination for appointment in the Dental Corps, U. S. Army, July 27-August 1. To be eligible to take this examination, an applicant must be a citizen of the United States; a graduate of a recognized dental school; in good standing in his profession; between the ages of 22½ and 31 years and 9 months at the time of the examination, and must have been engaged in the practice of his profession for at least one year and eleven months subsequent to date of graduation. Examinations will be held at Washington, D. C., Denver, Colo., San Francisco, Calif., and San Antonio, Texas. Applicants who qualify during this examination will be eligible for appointment to vacancies occurring in the Dental Corps, Regular Army, during the fiscal year ending June 30, 1937. Application forms may be obtained at any military post or station, or from the Ad-

jutant General of the Army, Washington, D. C.

OMICRON KAPPA UPSILON

The members of Omicron Kappa Upsilon will meet at the St. Francis Hotel, San Francisco, July 13-17. Fred T. West, 2595 Mission St., San Francisco, is the chairman of the local committee in charge of the luncheon.

ABRAM HOFFMAN, *Supreme Secretary,*
311 E. Chicago Ave.,
Chicago, Ill.

MONTREAL DENTAL CLUB FALL CLINIC

The twelfth annual fall clinic of the Montreal Dental Club will be held October 14-16 at the Mount Royal Hotel, Montreal.

J. K. CARVER, *Chairman,*
Publicity Committee,
394 Victoria Ave.,
Westmount, Quebec.

NEW ENGLAND HEALTH EDUCATION ASSOCIATION

The eleventh annual meeting of the New England Education Association will be held June 5-6 at the Massachusetts Institute of Technology, Cambridge, Mass.

MARION R. KANTER, *Publicity Chairman,*
Shirley Street,
Roxbury, Mass.

WARNING AGAINST ITINERANT SERVICE MEN

Dentists are warned against turning over instruments for repair to itinerant service men instead of employing known repair men for this work, in consideration of the risk of having instruments ruined or stolen. It is reported that a man who, some time ago, operated in the vicinity of Detroit, Mich., ostensibly repairing instruments, has forged the names of a number of practitioners as endorsing his work.

RAILROAD RATES TO SAN FRANCISCO

Low summer excursion rates will be in effect from all parts of the United States and Canada with a return limit to Oct. 31, 1936.

EXAMPLES OF ROUND TRIP RATES WHICH WILL APPLY

From	To San Francisco		
	1st Class	*Intermediate*	*Coach*
Chicago	$86.00	$68.80	$57.35
Minneapolis	86.00	68.80	57.35
New Orleans	85.15	68.15	56.80
Omaha	72.00	57.60	48.00

Consult your home ticket agent for detailed information regarding fares, routes, stopovers and attractions.

AMERICAN DENTAL ASSOCIATION

San Francisco, Calif. July 13-17, 1936.

HOTEL RESERVATION

In securing hotel reservations for the 1936 Session, consult the hotel rate sheet and fill out the blank application below. Mail immediately to the hotel you wish to patronize. The hotel will then advise you of the reservation that they make for you.

In case your first choice cannot be made, please indicate second and third choices. If none of your choices are available, the hotel manager will mail your application to the chairman of the Halls & Hotels Committee and he will place your reservation in as favorable a hotel as possible.

Please remember that a reservation constitutes a contract with the hotel to provide you with the accommodations you desire. If you find it impossible to carry out your part of the contract, namely, to occupy the room at the time agreed on, write or wire the hotel, releasing it in order that your room may be available for other members.

MAIL THIS APPLICATION DIRECT TO THE HOTEL
HOTEL RESERVATION

AMERICAN DENTAL ASSOCIATION, SAN FRANCISCO, CALIF., JULY 13-17, 1936.

.....Hotel.
San Francisco, Calif.

Please reserve sleeping accommodations as noted below:

.....Room(s) With bath for.....persons. Rate desired $.....

.....Room(s) Without bath for.....persons. Rate desired $.....

Third choice hotel..... Second choice hotel.....

ROOMS TO BE OCCUPIED BY: ADDRESS IN FULL

Applicant..... .....

....

....

....

Please confirm this reservation to applicant. I further agree to notify the hotel at once in the event I am unable to use this reservation.

IMPORTANT TO HOTEL MANAGER: In the event you cannot accept this reservation, please forward this application at once to Dr. C. W. Johnson, Chairman, Halls & Hotels Committee, 1160 Flood Bldg., San Francisco, Calif., who will attend to the assignment of this reservation.

HOTEL	WITH BATH		
	One Person	Two Persons	Twin Beds
ALEXANDER HAMILTON 613 O'Farrell St.			$6.50 Apts.
AMBASSADOR HOTEL Mason & Eddy Sts.	$2.50	$3.50	4.50
BRAYTON 50 Turk St.	2.00	2.50–3.00	3.50
CALIFORNIAN 405 Taylor St.	3.00	4.00	5.00
CLARK 217 Eddy St.	2.50–3.00	3.00	3.50
CLIFT Geary at Taylor St.	3.50	5.00	5.00–6.00–7.00 8.00–9.00
EL CORTEZ 550 Geary St.	3.00–3.50 4.00	4.50	5.00–6.00
FAIRMONT HOTEL California & Mason Sts.	3.50–4.00 5.00–6.00	5.00–6.00 7.00	6.00–8.00 10.00
FIELDING Geary & Mason Sts.		3.00	3.50
GAYLORD 620 Jones St.	2.50–3.00	3.50–4.00	4.00–5.00
HERBERT'S 151 Powell St.	1.50*	2.50*	
HOTEL BELLEVUE Geary & Taylor Sts.	2.50–3.00 3.50	3.50–4.00 4.50	4.50
HOTEL CANTERBURY 750 Sutter St.	3.00–3.50	4.50–5.50	4.50–5.50
HOTEL FRANCISCAN 350 Geary St.	2.50	3.50–4.00	4.50
HOTEL MANX 225 Powell St.	2.50	3.50–4.00	
HOTEL MAURICE 761 Post St.	3.00–3.50	4.50–5.50	5.50–6.50
HOTEL SENATOR 519 Ellis St.	2.00	2.50	3.00

*Without Bath Only.

HOTEL	WITH BATH		
	One Person	Two Persons	Twin Beds
HOTEL STEWART 353 Geary St.	2.50–3.00 3.50	4.00–4.50 5.00	4.00–4.50 5.00
HOTEL UTICA 333 Fulton St.	2.00–2.50	2.50–3.00	3.50–4.00
KING GEORGE 334 Mason St.		3.00–4.00	
MARK HOPKINS 999 California St.	4.00–5.00 6.00–7.00	6.00–7.00 8.00	7.00–8.00 9.00–10.00
MARYLAND 490 Geary St.	2.50	3.00	
OLYMPIC HOTEL 230 Eddy St.	2.50	3.50	4.00
OXFORD Mason & Turk Sts.		3.00	4.00
PALACE Market & New Montgomery Sts.	3.00–3.50–4.00 5.00–6.00	5.00–6.00 7.00	6.00–7.00 8.00
PLAZA 310 Post St.	2.00	3.00–3.50 4.00	4.50–5.00
PICKWICK 5th & Mission Sts.	2.50–3.00	3.50–4.00	4.50–5.00
RAMONA 174 Ellis St.		3.00	4.00
ST. FRANCIS Powell & Geary Sts.	3.50–4.00 5.00–6.00	5.00–6.00 7.00–8.00	6.00–7.00 8.00–10.00
SHAW 1112 Market St.	2.50	3.50	4.00
SIR FRANCIS DRAKE Sutter & Powell Sts.	3.00–3.50 4.00–5.00	5.00–6.00 7.00	6.00–7.00 8.00–9.00
SPAULDING 240 O'Farrell St.	2.00	3.00	
WHITCOMB 1231 Market St.	2.00–2.50–3.00 3.50–4.00	3.00–3.50 4.00	4.00–4.50 5.00–6.00
WILLIAM TAYLOR 100 McAllister St.	2.50–3.00 3.50	3.50–4.00	4.00–5.00 6.00

AMERICAN DENTAL ASSOCIATION
78TH ANNUAL SESSION
SAN FRANCISCO
JULY 13-17
• •
A Most Inclusive Program
of
Dental Achievements
• •
DISTINGUISHED GUEST ESSAYISTS AND CLINICIANS
• •
EXHIBITS AND CLINICS ILLUSTRATING THE LATEST DEVELOPMENTS IN DENTAL AND ALLIED SUBJECTS
• •
Cool Ocean Breezes
Invite You!

Cool breezes from the Pacific Ocean and clear sparkling California sunshine will make the entire convention a delight. . . . .

Gay, romantic San Francisco invites you to visit her quaint Japanese Tea Gardens, to burn incense in her colorful Chinatown, to play golf on her magnificent golf courses, to witness the construction of the world's two largest bridges and to participate in scores of other delights of the seacoast city. . .

San Francisco has prepared for you trips of intense interest and surpassing beauty, pageants of color and splendor, entertainment that will capture the fancy of all. . . . .

New low transportation rates and diversified routing offer a travel opportunity that is a tremendous attraction in itself. . . . .

Vacation in San Francisco
July 13 to 17!

OFFICERS AND TRUSTEES OF THE AMERICAN DENTAL ASSOCIATION
1935-1936

PRESIDENT

George B. Winter.....Frisco Bldg., St. Louis, Mo.

PRESIDENT ELECT

Leroy M. S. Miner.....363 Marlborough St., Boston, Mass.

VICE PRESIDENTS

Frederick J. Wolfe.....Maison Blanche, New Orleans, La.
Fred R. Adams.....80 West Fortieth St., New York City
Homer B. Robison.....Rorabaugh-Wiley Bldg., Hutchinson, Kan.

SECRETARY

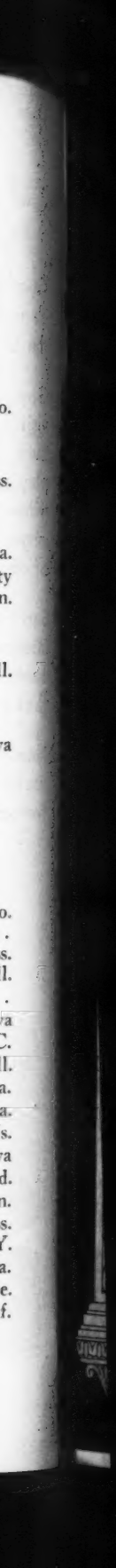
Harry B. Pinney.....212 E. Superior St., Chicago, Ill.

TREASURER

R. H. Volland.....First Capital Nat'l Bank Bldg., Iowa City, Iowa

BOARD OF TRUSTEES

George B. Winter, President, Ex-Officio.....Frisco Bldg., St. Louis, Mo.
Leroy M. S. Miner, President Elect, Ex-Officio.....
.....363 Marlborough St., Boston, Mass.
Harry B. Pinney, Secretary, Ex-Officio.....212 E. Superior St., Chicago, Ill.
R. H. Volland, Treasurer, Ex-Officio.....
.....First Capital Nat'l Bank Bldg., Iowa City, Iowa
C. Willard Camalier, '38.....1726 Eye St., N. W., Washington, D. C.
Thomas L. Grisamore, '38.....29 E. Madison St., Chicago, Ill.
E. G. Meisel, '38.....121 University Place, Pittsburgh, Pa.
C. J. Caraballo, '38.....Stovall Bldg., Tampa, Fla.
George E. Morgan, '38.....2039 North Prospect Ave., Milwaukee, Wis.
J. G. Hildebrand, '37.....Waterloo, Iowa
Albert R. Ross, '37.....Murdock Bldg., Lafayette, Ind.
Oren A. Oliver, '37.....Medical Arts Bldg., Nashville, Tenn.
Philip E. Adams, '37.....106 Marlborough St., Boston, Mass.
Harvey J. Burkhart, '36.....Box 879, East Avenue P. O., Rochester, N. Y.
C. R. Lawrence, '36.....730 Bass Bldg., Enid, Okla.
Herbert C. Miller, '36.....E. 6th and Oregon Sts., Portland, Ore.
Wilfred H. Robinson, '36.....1706 Broadway, Oakland, Calif.



TEXAS STATE DENTAL SOCIETY

The fifty-sixth annual convention of the Texas State Dental Society will be held in Dallas, August 31-September 4, in conjunction with the Texas Centennial Exposition. For additional information, address

J. G. FIFE, *Secretary*,
Medical Arts Bldg.,
Dallas.

ARIZONA STATE DENTAL BOARD

The Arizona State Dental Board will meet in Flagstaff the week beginning August 3 for the examination of applicants for license to practice dentistry in the State of Arizona. Applications must be in the hands of the secretary at least fifteen days before the meeting. For further information, address

R. A. MCCALL, *Secretary*,
719 Professional Bldg.,
Phoenix.

MASSACHUSETTS BOARD OF DENTAL EXAMINERS

The next examination to be conducted by the Massachusetts Board of Dental Examiners will be held in Boston, June 10-13. All applications must be filed at the office of the secretary at least ten days before the date set for the examination. For further information, address

FRANCIS M. CAHILL, *Secretary*,
141 State House,
Boston.

MINNESOTA STATE BOARD OF DENTAL EXAMINERS

The next examination of the Minnesota State Board of Dental Examiners will be held at the College of Dentistry, University of Minnesota, Minneapolis, June 19-25, for licenses to practice dentistry and dental hygiene in the state. There is reciprocity with North and South Dakota. All applications must be filed with the secretary at least ten days prior to the examination. Address all communications regarding particulars to

PAUL HAGEN, *Secretary*,
Crookston.

STATE OF NEBRASKA EXAMINING BOARD

The next dental examination of the State of Nebraska Bureau of Examining Boards will be given June 15-20. The practical examination will be held the first three days at the University College of Dentistry, Lincoln, and Creighton College of Dentistry, Omaha. The written examination will be held the last three days at the State House, Lincoln. All applications should be on file at least fifteen days prior to the date of the examination.

MRS. CLARK PERKINS, *Director*,
Bureau of Examining Boards,
Lincoln.

SOUTH DAKOTA STATE BOARD OF DENTAL EXAMINERS

The South Dakota State Board of Dental Examiners will conduct examinations June 22-25 at Sioux Falls. For further information, applications, etc., address

H. C. WHITNEY, *Secretary*,
Wessington Springs.

TENNESSEE BOARD OF DENTAL EXAMINERS

The Tennessee Board of Dental Examiners will hold its annual examinations of dentists and hygienists June 8, beginning at 8 a.m., at the University of Tennessee Dental College, Memphis.

B. C. GALLIMORE, *Secretary*,
Commercial Bank Bldg.,
McKenzie.

WISCONSIN STATE BOARD OF DENTAL EXAMINERS

(Correction of Dates)

The next meeting of the Wisconsin State Board of Dental Examiners will be held at the Milwaukee College of Dentistry, Milwaukee, June 22-26.

S. F. DONOVAN, *Secretary*,
Tomah.

AMERICAN ASSOCIATION OF DENTAL EDITORS

The sixth annual meeting of the American Association of Dental Editors will be held in the St. Francis Hotel, San Francisco, July 11.

O. W. BRANDHORST, *Secretary*,
4500 Olive St.,
St. Louis, Mo.

AMERICAN COLLEGE OF DENTISTS

The American College of Dentists will hold its annual convocation at the St. Francis Hotel, San Francisco, July 12.

O. W. BRANDHORST, *Secretary*,
4500 Olive St.,
St. Louis, Mo.

PAST PRESIDENTS' LUNCHEON

The Past Presidents' Club of the American Dental Association will hold its annual luncheon at 12:30, July 14, at the St. Francis Hotel. The annual address will be delivered by Thomas B. Hartzell. All Past Presidents in attendance at the San Francisco meeting are requested to be present at this luncheon.

HOMER C. BROWN, *Secretary*,
609 Hartman Bldg.,
Columbus, Ohio.

INTERNATIONAL ASSOCIATION FOR DENTAL RESEARCH

The San Francisco Section of the International Association for Dental Research will meet for luncheon in the St. Francis Hotel, July 13, at 12 m. All members attending the Annual Session of the A.D.A. are invited.

INGO HACKH, *Secretary*,
344 Fourteenth St.,
San Francisco.

EXAMINATION FOR APPOINTMENT IN THE DENTAL CORPS OF THE NAVY

A competitive examination to select not more than twenty for appointment in the Dental Corps of the Navy, when their services are required, will be held July 20, at the Naval Dental School, Washington, D. C., Naval Training Station, Great Lakes, Ill., and Naval Training Station, San Diego, Calif. A candidate for appointment in the Dental Corps must be a citizen of the United States, and must be between 21 and 32 years of age at the time of appointment, a graduate of a standard dental college, of good moral character and of unquestionable professional repute. Credentials relative to character, citizenship, date of birth and education must be submitted and approved before an applicant can be authorized to appear for examination. A circular which contains full information relative to the Dental Corps and describes the method of making application for appointment can be obtained from the Bureau of Medicine and Surgery, Navy Department, Washington, D. C.

P. S. ROSSITER, *Surgeon General*,
U. S. Navy.

EXAMINATION FOR APPOINTMENT IN THE DENTAL CORPS, U. S. ARMY

There will be an examination for appointment in the Dental Corps, U. S. Army, July 27-August 1. To be eligible to take this examination, an applicant must be a citizen of the United States; a graduate of a recognized dental school; in good standing in his profession; between the ages of 22½ and 31 years and 9 months at the time of the examination, and must have been engaged in the practice of his profession for at least one year and eleven months subsequent to date of graduation. Examinations will be held at Washington, D. C., Denver, Colo., San Francisco, Calif., and San Antonio, Texas. Applicants who qualify during this examination will be eligible for appointment to vacancies occurring in the Dental Corps, Regular Army, during the fiscal year ending June 30, 1937. Application forms may be obtained at any military post or station, or from the Ad-

jutant General of the Army, Washington, D. C.

OMICRON KAPPA UPSILON

The members of Omicron Kappa Upsilon will meet at the St. Francis Hotel, San Francisco, July 13-17. Fred T. West, 2595 Mission St., San Francisco, is the chairman of the local committee in charge of the luncheon.

ABRAM HOFFMAN, *Supreme Secretary,*
311 E. Chicago Ave.,
Chicago, Ill.

MONTREAL DENTAL CLUB FALL CLINIC

The twelfth annual fall clinic of the Montreal Dental Club will be held October 14-16 at the Mount Royal Hotel, Montreal.

J. K. CARVER, *Chairman,*
Publicity Committee,
394 Victoria Ave.,
Westmount, Quebec.

NEW ENGLAND HEALTH EDUCATION ASSOCIATION

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Shirley Street,
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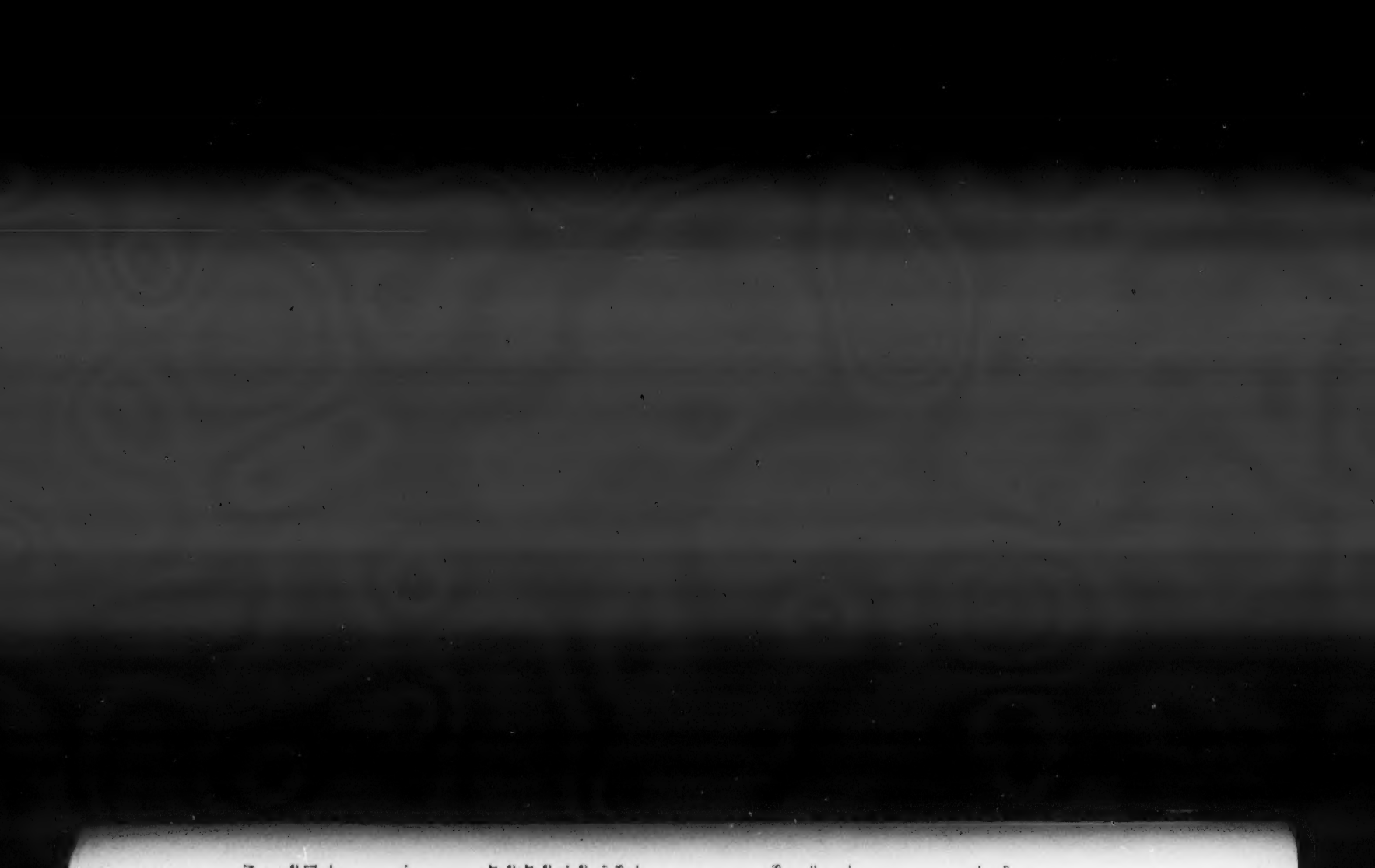
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